FINAL
ENVIRONMENTAL INFORMATION
VOLUME

for

LIFAC DEMONSTRATION
RETROFIT FLUE GAS DESULFURIZATION
TECHNOLOGY

RICHMOND POWER & LIGHT
WHITEWATER VALLEY GENERATING STATION
UNIT 2
RICHMOND, INDIANA

Submitted By

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LIST OF ACRONYMS AND ABBREVIATIONS

ACFM	Actual Cubic Feet per Minute
APCB	Air Pollution Control Board
Btu	British Thermal Unit
CE	Combustion Engineering
CFR	Code of Federal Regulations
CO_2	Carbon Dioxide
DOE	U.S. Department of Energy
EERC	Energy and Environmental Research Corporation
EHSS	Environmental, Health, Safety and Socioeconomic
EIV	Environmental Information Volume
EPRI	Electric Power Research Institute
ESP	Electrostatic Precipitator
EPA	Environmental Protection Agency
FD	Forced Draft
GE	General Electric
HLI	Historic Landmarks of Indiana
IAW	Indiana American Water Company
ID	Induced Draft
IDEM	Indiana Department of Environmental Management
LIFAC	Limestone Injection into the Furnace with calcium oxide ACtivation
LIMB	Limestone Injection Multi-Stage Burner
MES	Meteorological Evaluation Services

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

MGD	Million Gallons Per Day
MMBtu	Million British Thermal Unit
MW	Megawatt
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NO_x	Nitrogen Oxides
NSPS	New Source Performance Standards
PON	Program Opportunity Notice
PPM	Parts Per Million
RP&L	Richmond Power & Light
RP&RD	Richmond Parks & Recreation Department
SCA	Specific Collection Area
SDWA	Safe Drinking Water Act
SO_2	Sulfur Dioxide
SO_x	Sulfur Oxides
USDI	United States Department of the Interior
USEPA	United States Environmental Protection Agency
USF&WS	United States Fish & Wildlife Service
USGS	United States Geological Survey

SECTION 1.0

INTRODUCTION

1.0 INTRODUCTION

LIFAC-North America proposes to demonstrate that Limestone Injection into the Furnace with calcium oxide ACtivation (LIFAC), a control technology for the acid rain precursor sulfur dioxide (SO_2), is suitable for retrofit application at utility plants constructed prior to the effective date of the New Source Performance Standards (NSPS). The goal of this program is to prove the technical and economic feasibility of the LIFAC process. Based on experience with LIFAC installations in Finland, it is anticipated that the LIFAC technology will reduce SO_2 emissions up to 85% without increases in the emission of other undesirable chemical compounds. LIFAC is economical, delivering satisfactory results without wasting fuel and at a lower cost than wet flue gas desulfurization processes.

The LIFAC technology removes sulfur oxides (SO_x) from the flue gas by reacting them with limestone constituents, producing a fine, powdery, solid waste that can be easily captured prior to discharge to the atmosphere. Pulverized limestone is injected into the upper regions of a coal-fired boiler where it breaks down chemically to form calcium oxide and carbon dioxide. Some of the calcium oxide reacts immediately with sulfur dioxide or sulfur trioxide from the burning coal to form calcium sulfite and calcium sulfate. The unreacted calcium oxide is carried with the flue gas into an activation chamber installed between the air preheater and the particulate control equipment. A water mist is added in the activation chamber causing the calcium oxide to form calcium hydroxide. The calcium hydroxide then reacts with additional sulfur dioxide, completing the removal process. Approximately three-quarters of the LIFAC waste is collected by the particle control equipment, and the remainder exits via hoppers at the bottom of the activation chamber.

Due to the addition of the limestone and the subsequent reactions, there will be a net increase in the amount of solid waste produced by the boiler during the LIFAC demonstration. There will also be an increase in carbon dioxide emission due to the calcination of calcium carbonate; however, this is true of all processes using limestone as an adsorbent. The increase in carbon dioxide (CO_2) will account for approximately 3% of the CO_2 in the flue gas and is considered acceptable considering the reduction in sulfur dioxide attributable to operation of the LIFAC system.

LIFAC-North America's demonstration program focuses on an Indiana utility boiler that represents technology typical of that used at existing plants across the United States. The host boiler is the 60 megawatt (MW), tangentially-fired Unit 2 at Richmond Power & Light's (RP&L) Whitewater Valley Station. This Environmental Information Volume (EIV) describes the proposed demonstration and the environmental impacts associated with its application.

SECTION 2.0

PROPOSED ACTION AND ITS ALTERNATIVES

2.0 PROPOSED ACTION AND ITS ALTERNATIVES

This chapter describes the existing Whitewater Valley Generating Station, outlines the proposed technology associated with the LIFAC demonstration, describes anticipated project activities and forecasts resource and discharge essentials. This section also presents alternatives to the use of LIFAC.

2.1 Proposed Action

2.1.1 Site Description

RP&L is located in Wayne County, Indiana, near the southern boundary of the city of Richmond. Wayne County is located in the east central part of the state and has the Indiana-Ohio state line as it eastern border. Figure 2-1 shows the location of RP&L and Wayne County in Indiana. Figure 2-2 shows the location of the facility with respect to the city and other regional features.

The layout of the RP&L plant is illustrated in the aerial view of Figure 2-3. The building in the center of the photograph is the Whitewater Valley Generating Station boiler building, which houses the boilers, generators and electrostatic precipitators (ESPs) for the plant. When the photograph was taken, the new stack was not in place, but has since been constructed on the east side of the building. South of the boiler building and tapering off to the west is the coal storage area. Conveyors transport coal from the stockpile to a pulverizer and finally to the boiler building, as shown in the photograph. A clarifier for water treatment, the cooling towers and the cooling water holding tank are southwest of the boiler building. The fly ash pond is seen west of the boiler building tapering off to the northwest. East of the fly ash pond are three sedimentation basins for control of surface runoff and non-contact process water. A switching station occupies the area north of the boiler building. The RP&L offices and storage areas lie east of the coal storage area. Additional features of the RP&L generating station are identified on the plan view presented in Figure 2-4.

FIGURE 2-1
LOCATION MAP

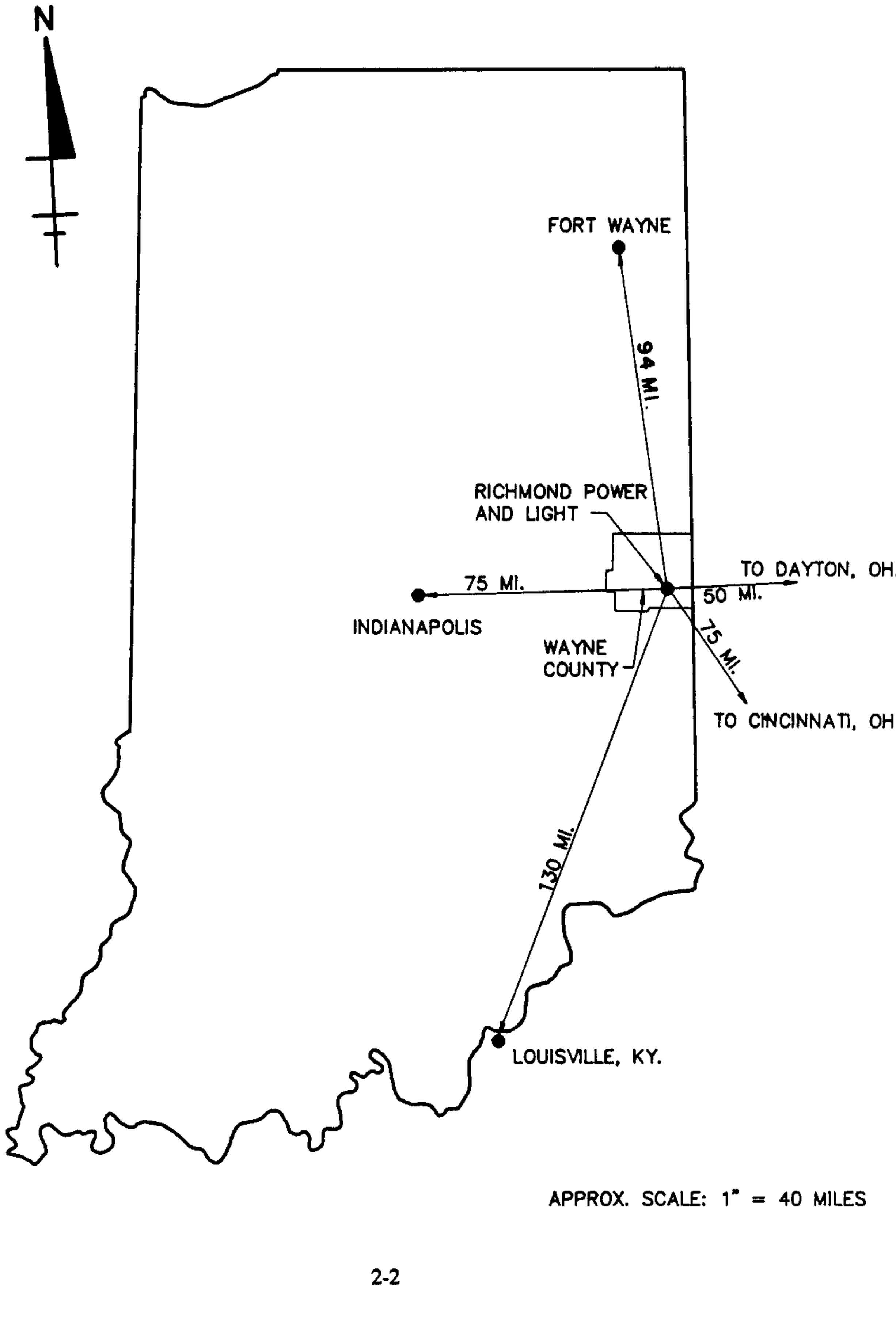
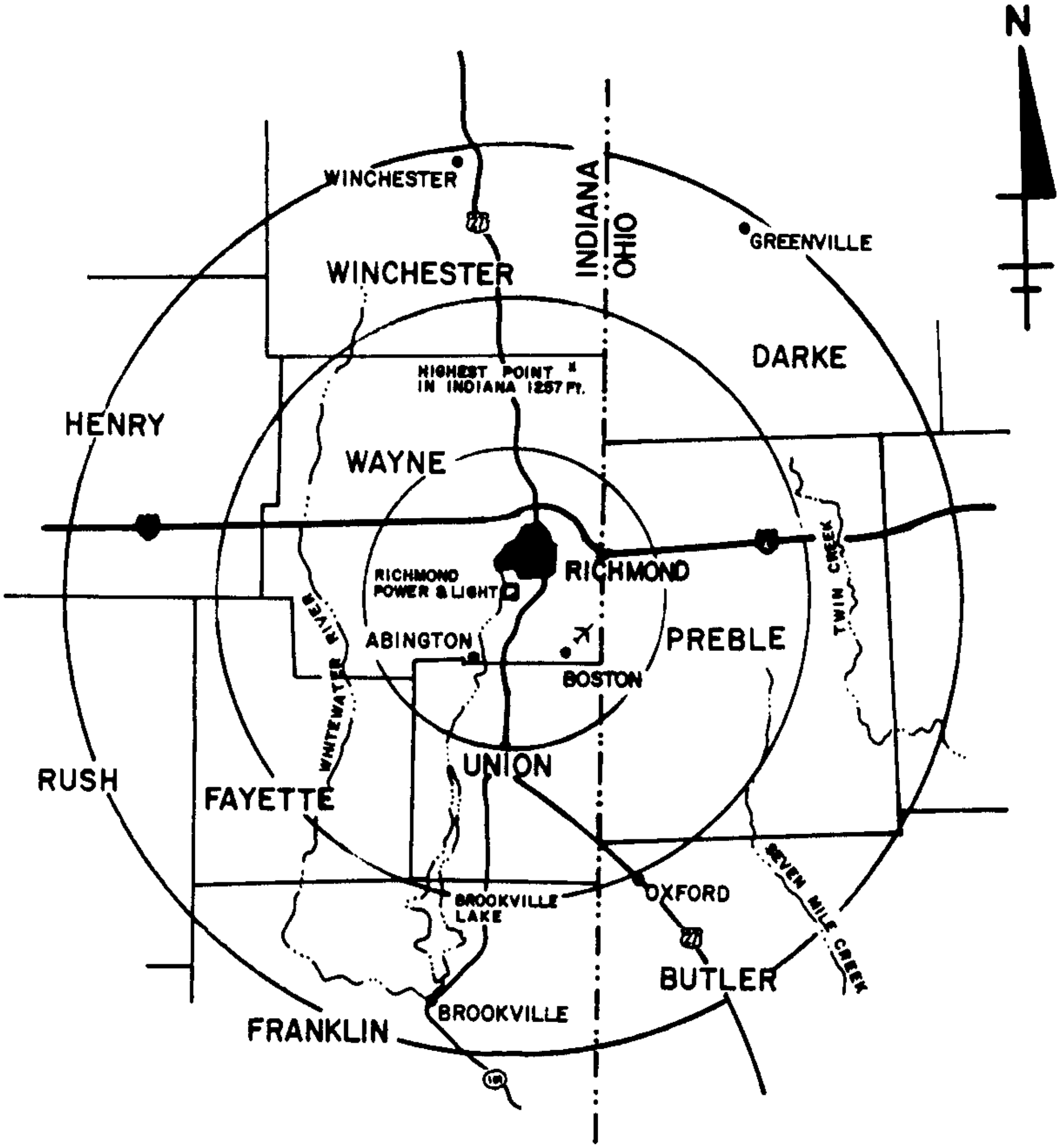


FIGURE 2-2
WAYNE COUNTY AND SURROUNDING REGIONAL FEATURES



APPROX. SCALE: 1" = 11.6 MILES
(RINGS AT 10 MILE INTERVALS)

FIGURE 2-3

AERIAL PHOTOGRAPH OF RICHMOND
POWER & LIGHT FACILITY

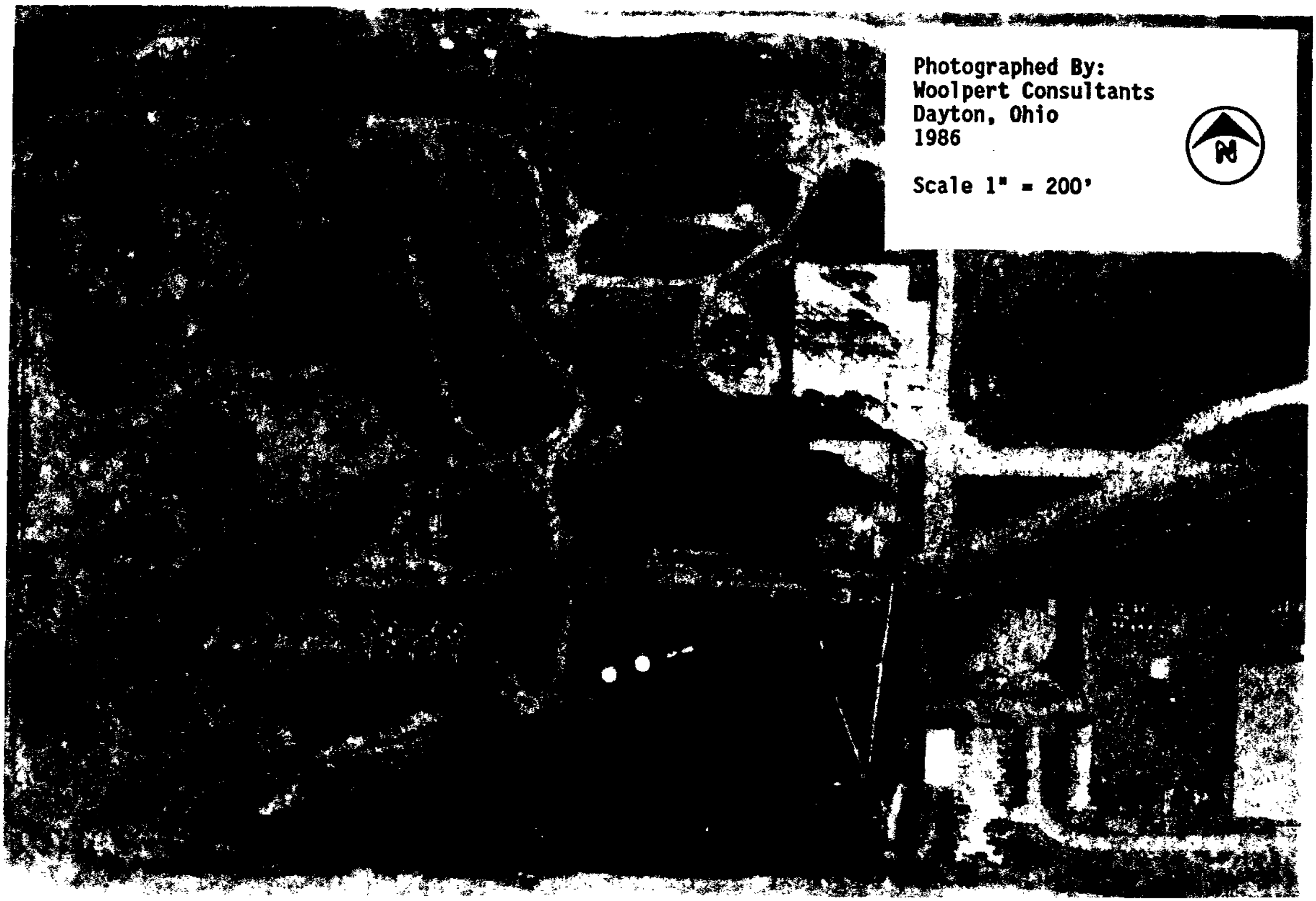
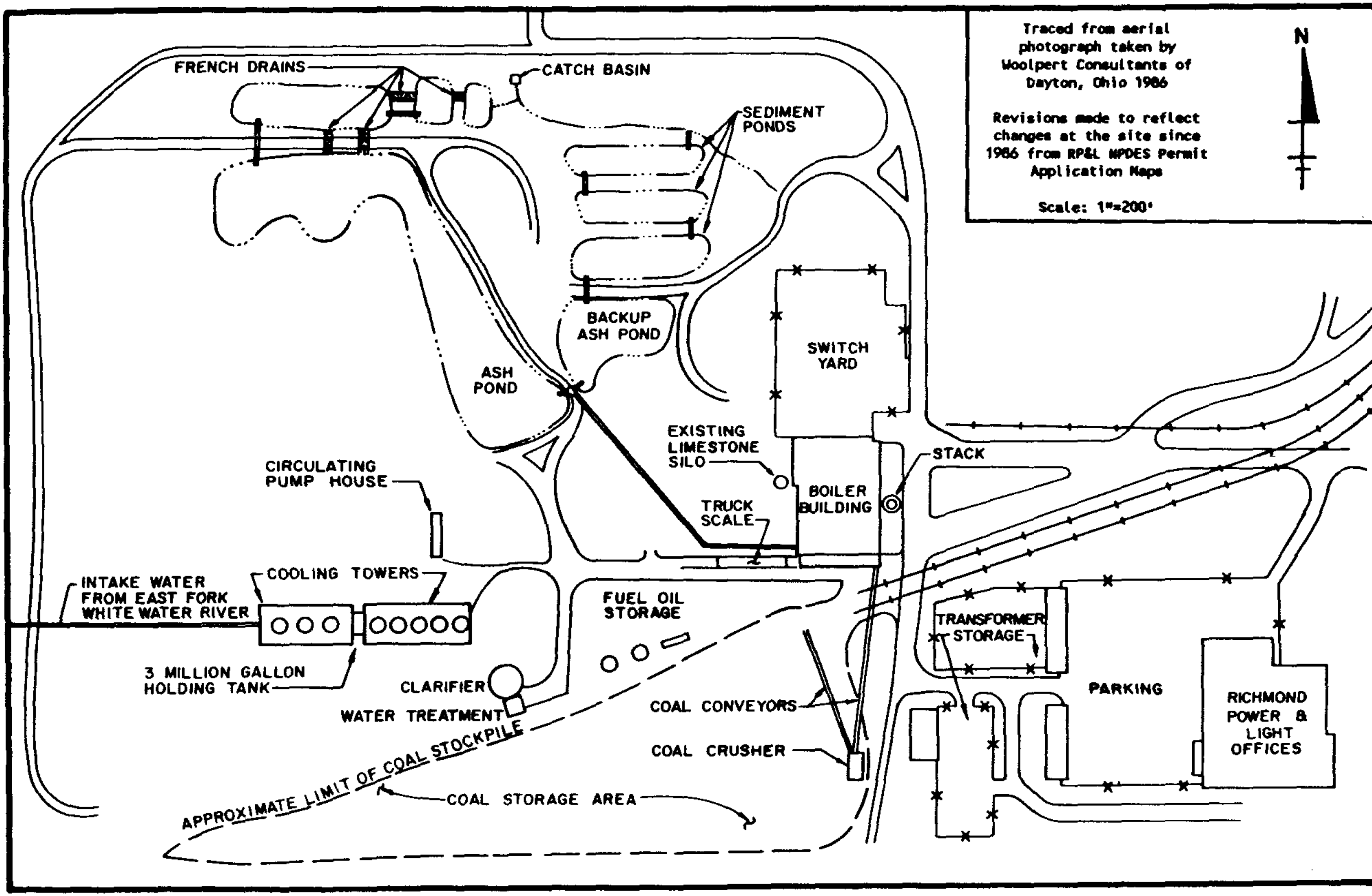


FIGURE 2-4
SITE PLAN



The Whitewater Valley Generating Station is accessible by rail and truck. Richmond is served by the Penn Central, Norfolk and Chesapeake & Ohio railroads. From Interstate Route 70, trucks can reach the site using US Route 27. Water needs at the plant are met by pumping water from the East Fork Whitewater River which flows through the city of Richmond and within one mile of the powerplant or through Indiana American Water (IAW), a privately owned water company in the city.

Whitewater Valley operates two boiler-turbine units with a combined capacity rated at 93 MW. Unit 1, which began producing energy in March 1955, is a General Electric (GE) steam-driven turbogenerator and a Riley boiler. Unit 1 has a continuous capacity rating of 33 MW at 85% power factor. Unit 2, which has been in service since May 1973, has a GE turbine and a Combustion Engineering (CE) boiler. Unit 2 has a continuous capacity rating of 60 MW at 85% power factor. Both units are housed in the same boiler building constructed in the early 1950s and each has a single ESP located on the roof of the adjacent turbine generator building. The flue gas streams from each ESP feed into a common stack next to the boiler building. The common stack went into operation in the fall of 1989.

The RP&L system is linked to the Indiana & Michigan Electric Company at the Richmond and Hodgkin Substations. These interconnections provide the RP&L system with an additional 265 MW capacity, creating a total system capacity of about 358 MW.

2.1.2 Existing Plant Operation (Unit 2)

Unit 2 is operated as a baseload unit at a utilization typically ranging from 70-77%. Based on a net generating capacity of 60 MW, the full load coal firing capacity of the unit is 30 tons per hour, as presented in Table 2-1. The furnace is equipped with 24 sootblowers that inject steam when necessary to control wall deposits. During sootblowing and start-up, the furnace may utilize a fuel oil injection to preserve or ignite the explosion process.

The furnace exhaust gases move to primary and secondary superheaters, each equipped with two sootblowers. The gas then moves through an economizer with a finned tube design to a Lonstrum horizontal axis regenerative air heater. Finally the gas travels to a Lodge-Cottrell cold-side ESP with a designed specific collection area (SCA) of 198 ft^2/100 ACFM, which is capable of removing 99.9% of the fly ash. The ESP utilizes four separately energized electric fields in series

Table 2-1

WHITEWATER VALLEY STATION
GENERAL COAL CHARACTERISTICS
BASELINE OPERATION

Low Heating Value	11,300 Btu/lb (ref A)
Consumption	30 tons/hour (ref B)
Coal Ultimate Analysis (Dry Basis)	(ref A)
Carbon (%)	69 - 72
Sulfur (%)	2.4 - 2.9
Hydrogen (%)	4.4 - 5.3
Nitrogen (%)	1.25 - 1.42
Oxygen (%)	7.6 - 8.5
Coal Proximate Analysis	(ref A)
Moisture (%) (As received)	12.5 - 13.5
Ash (%) (Dry)	11
Elemental Ash Analysis	(ref C)
Silicon Dioxide (%)	10 - 70
Aluminum Oxide (%)	8 - 38
Ferric Oxide (%)	2 - 50
Calcium Oxide (%)	0.5 - 30
Magnesium Oxide (%)	0.3 - 8
Sodium Oxide (%)	0.1 - 8
Potassium Oxide (%)	0.1 - 3
Titanium Dioxide (%)	0.4 - 3.5
Sulfur Trioxide (%)	0.1 - 30

(A) Coal characterization tests run by Hazen Research, Inc. for EERC during the LIMB project October 1988.

(B) Estimate based on rated heat input capacity (Table 2-2) and the approximate low heating value.

(C) U.S. Bureau of Mines Bulletin 567.

with mechanical rappers on the collector and discharger. A schematic of the system is included as Figure 2-5.

The main boiler fuel is Indiana bituminous coal having a sulfur content between 2.4% and 2.9%. Typical dry basis ultimate and proximate analyses for the coal are shown in Table 2-1. A 70-day supply of coal is stockpiled on-site but the plant commonly burns coal which is delivered daily. Truckloads of coal are dumped directly onto a conveyor that carries the fuel to a crusher where it is reduced to an average diameter of approximately 1/2 inch. A second conveyor then carries the coal to the top of the power plant where it is distributed to six 300 ton coal bunkers. There are three bunkers for each boiler. The coal is then gravity fed to scales weighing out 300 pound loads and dumped to pulverizes that reduce the coal to a flour-fine consistency. This powdery coal is mixed with preheated air and blown into the boiler. Within the boiler the mixture immediately ignites in a continuous, controlled explosion and heats the water circulating throughout the boiler tubes to generate steam. This steam is used to turn turbines that produce electricity. Design features, equipment information and system data are included in Tables 2-2, 2-3 and 2-4.

Of the ash produced by the process, 20% leaves the system as bottom ash. The bottom ash settles in the boiler and is sluiced to a dewatering bin, loaded into trucks, weighed and landfilled off-site at the Richmond municipal facility or at a quarry owned by RP&L. Any ash mixing with the sluice water is discharged to the ash ponds where it settles and is later dredged, spread by a dozer to hasten drying and hauled to the landfill or quarry.

Fly ash represents the remaining 80% of the coal's original ash content. The fly ash is pulled from the ESP hoppers using a hydroveyor system that utilizes a high pressure water flow to produce the vacuum. The fly ash is transferred to a storage silo that is periodically emptied into trucks using a dustless unloader. The fly ash is hauled to the RP&L quarry, the municipal landfill or sold to contractors for reuse. (In the past Unit 2 fly ash has been purchased for use in concrete production; however, no ash is presently sold. The ash market is exploratory in nature but use of the material as a component of redi-mix and as backfill for construction activities have begun and a demand for all the fly ash Unit 2 can produce is anticipated for the future) (Keller, 1990). Some fly ash mixes with the water is in the vacuum system and is carried through a discharge pipe to the ash ponds where it settles and is later dredged, spread by a dozer to hasten drying and loaded onto trucks to be landfilled.

FIGURE 2-5
WHITEWATER VALLEY UNIT 2 SYSTEM SCHEMATIC

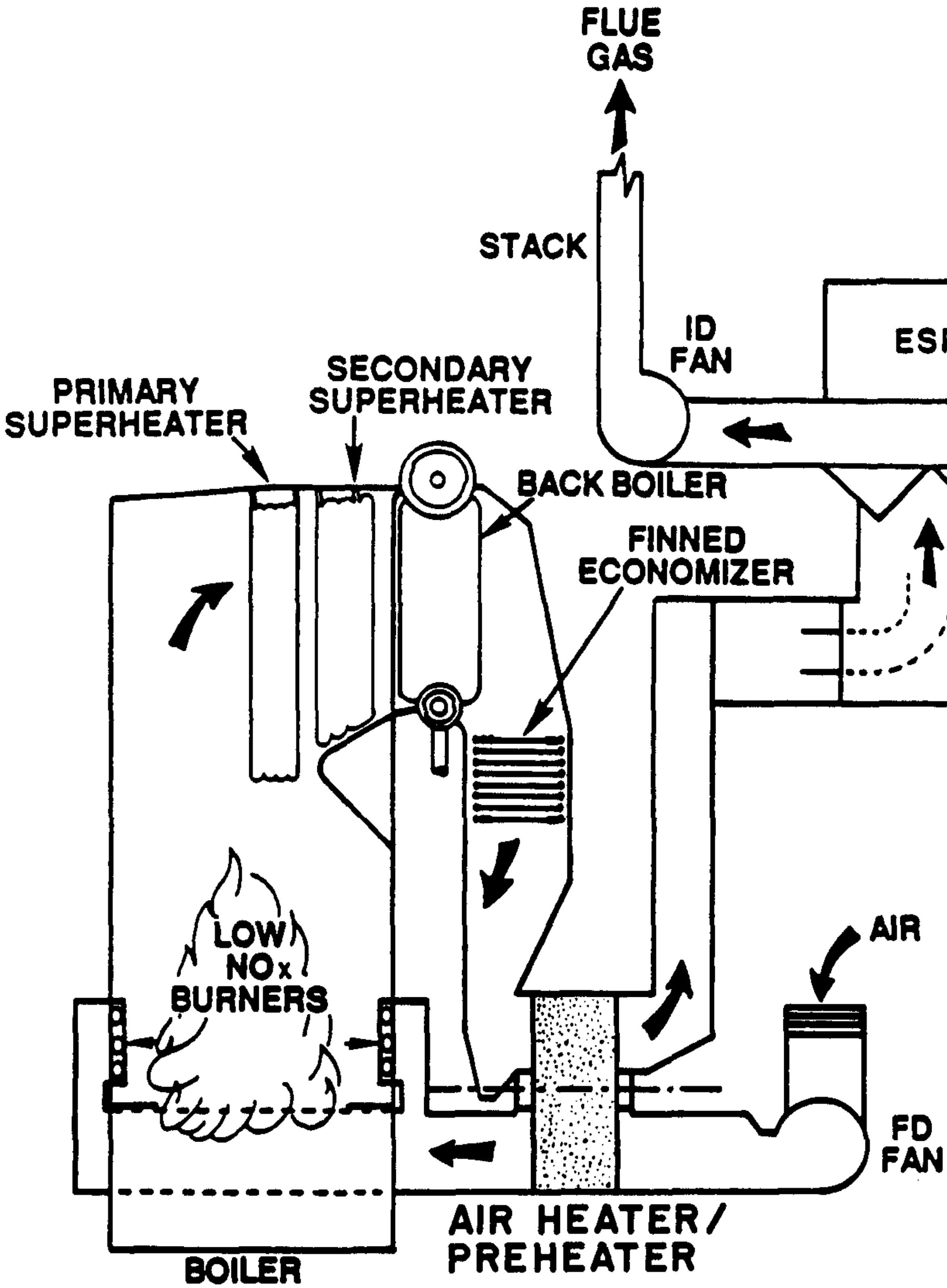


TABLE 2-2

WHITEWATER VALLEY UNIT 2
DESIGN FEATURES AND EQUIPMENT INFORMATION

Boiler type	CE YU-40 rated at 60 MW
Steam flow @ rated capacity	540,000 lb/hr
Heat input @ rated capacity	651 x 10^6 Btu/hr
Air flow (secondary)	660,000 lb/hr
Air temperature to windbox	536°F
Furnace width	24 ft 8 in
Furnace depth	26 ft 11 in
Boiler heating surface	16,255 ft^2
Waterwall heating surface	9,225 ft^2
Economizer heating surface	20,400 ft^2
Pulverizers	Three 593 R (with exhausters)
Pulverizers capacity	26,400 lb/hr with 52 grind. coal and 70% <200 mesh

TABLE 2-3

WHITEWATER VALLEY UNIT 2
BOILER FEATURES
CE CONTRACT 23470

PREDICTED PERFORMANCE*

Fuel		MIDWEST BITUMINOUS COAL		
Evaporation	lb/hr	590,000	540,000	324,000
Feedwater Temperature	°F	445	440	393
Superheater Outlet Temperature	°F	955	995	955
Superheater Outlet Pressure	psig	1,380	1,320	1,275
Boiler Outlet Pressure	psig	1,469	1,395	1,305
Superheater Pressure Drop	psi	89.0	75.0	30.0
Economizer Pressure Drop	psi	6.0	5.0	2.0
Efficiency	%	87.33	87.47	88.17
Fuel Fired	lb/hr	65,500	58,500	36,600
CO_2/Excess Air Leaving Boiler	%	15.1/20	15.1/20	14.6/25
Gas Leaving Boiler	lb/hr	700,000	645,000	422,000
Gas Temperature Leaving Boiler	°F	900	875	775
Gas Temp. Leaving Economizer	°F	685	665	555
Gas Temp. Leaving Air Heater (Uncorr.)	°F	306	300	256
Gas Temp. Leaving Air Heater (Corr.)	°F	292	285	245
Ambient Air				
Temperature	°F	80	80	80
Relative Humidity	%	60	60	60
Air to Air Heater	°F	80	80	80
Air Temp. Leaving Air Heater	°F	539	530	471
Air Leaving Air Heater	lb/hr	608,000	555,000	339,000
Air Heater Leakage	lb/hr	51,000	47,000	32,000
Pressure Drop**				
Windbox	"wg	3.50	3.00	1.10
Air Heater, Air Side	"wg	4.70	4.00	1.60
Air Ducts & Air Foil	"wg	1.70	1.40	0.60
Hot Water Air Heater	"wg	0.70	0.60	0.25
Total	"wg	10.60	9.00	3.55
Draft Loss**				
Furnace	"wg	0.10	0.10	0.10
Boiler & Superheater	"wg	1.00	0.84	0.40
Economizer	"wg	3.00	2.60	1.15
Air Heater, Gas Side	"wg	6.70	5.80	2.65
Gas Ducts & Stack	"wg	1.80	1.52	0.65
Precipitator	"wg	1.00	.84	0.34
Total	"wg	13.60	11.70	4.29

Notes: * These performance figures are predictions only and are not to be construed as being guaranteed except where the points coincide with the guarantees.
** Pressure and draft losses are at 1005 ft.

TABLE 2-4

WHITEWATER VALLEY UNIT 2
ESP FEATURES

Plant Size	BIILCSA4F-7.5x30-25
Gas Volume (CFM Actual)	227,000
Temperature (°F)	285
Collection Area (ft^2)	45,000
SCA	198
Inlet Fly Ash Burden (lb/hr)	5,000
Inlet Burden (gr/ft^3)	3.9
Gas Velocity (ft/sec.)	5.5
Treatment Time (sec)	5.46
Efficiency (%)	99.9
Hopper Storage Capacity (hours)	12
Casing Design Pressure (ins H_20)	10
Casing Design Vacuum (ins H_2O)	20
Casing Design Temp °F	350
Wind Load PSF	30
Snow Load	20
Hoppers in Length	2
Hoppers in Width	2
Hopper Min. Valley Angle	65
Casing and Hoppers Mat'l	1/4" Corten Steel (ASTM A242)
Structural Steel	Catch space collectors 18g M.S. sheets 16g M.S. channels
Collector Rapping	Drop rod double sided rapping
Collector Suspension	Springs suitable for 710 °F
Discharge Electrodes	Mast electrodes-two wires std. fluted square section. std. flattened top.
Discharge Suspension	7'-6" top frames. Springs for 710 °F SLTR lead through insulator
Discharge Rapping	Drop rod
Electrical Supply	480V 3PH 60 HZ
Rectifiers	(60KW 250 MA - L.C. ratings for Unit No. 2)

Note: Two of the 4 precipitator hoppers on Unit 2 have been modified to a conical design; resulting in a lower collection capacity but this has eliminated condensation and thus reduced corrosion problems.

A detailed flow profile for water at the facility is included as Figure 2-6. Approximately 1.8 million gallons of river water are pumped to the powerplant each day for use as cooling water, as a seal for the boilers or to create a suction for the ash transport system. Two pumps deliver the water from the East Fork Whitewater River through a common header. Prior to use, the water may undergo clarification or chemical stabilization (i.e., pH adjustment) at the on-site water treatment facility. Cooling water for the plant is stored in a three-million-gallon holding tank located 200 yards southwest of the boiler building. Circulator pumps cycle the water from the holding tank to condensers where the water is used to cool steam from the boiler. The water then moves to cooling towers and back to the holding tank, completing the cycle. Some cooling water may evaporate in the cooling towers but is replenished using the river pumps. If needed, the cooling water stream may be diverted for use in the hydroveyor ash collection system. Water used for ash collection, boiler sealing and cooling tower blowdown does not recirculate, but moves to on-site sedimentation ponds and into an on-site city storm sewer. If problems occur with the river pumps, a back-up water supply is available from Indiana American Water.

Process flow diagrams for all feed streams and waste streams are presented in Figures 2-7 and 2-8. Figure 2-7 represents Whitewater Valley Unit 2 for full-load hourly baseline operating conditions, while Figure 2-8 represents Whitewater Valley Unit 2 for yearly baseload operating conditions at a utilization of 75%.

2.1.3 Engineering Description of Proposed Action

This section describes the demonstration project phases and the installation of the LIFAC components to the current Whitewater Valley facility, defines the project components and investigates potential Environmental, Health, Safety and Socioeconomic (EHSS) receptors.

LIFAC is a flue gas desulfurization technology providing a cost-effective SO_2 emission reduction from powerplants. The technology provides the ability to reduce SO_2 emissions 75-85% utilizing limestone injection into the boiler and humidification. An activation chamber is also installed between the powerplant's air preheater and its ESP, providing the limestone a larger residence time. The LIFAC technology was developed by Tampella in response to environmental regulations in Finland imposed in 1983 requiring reduction in SO_2 emissions from all fossil-fueled

FIGURE 2-6
WHITEWATER VALLEY
WATER FLOW PROFILE

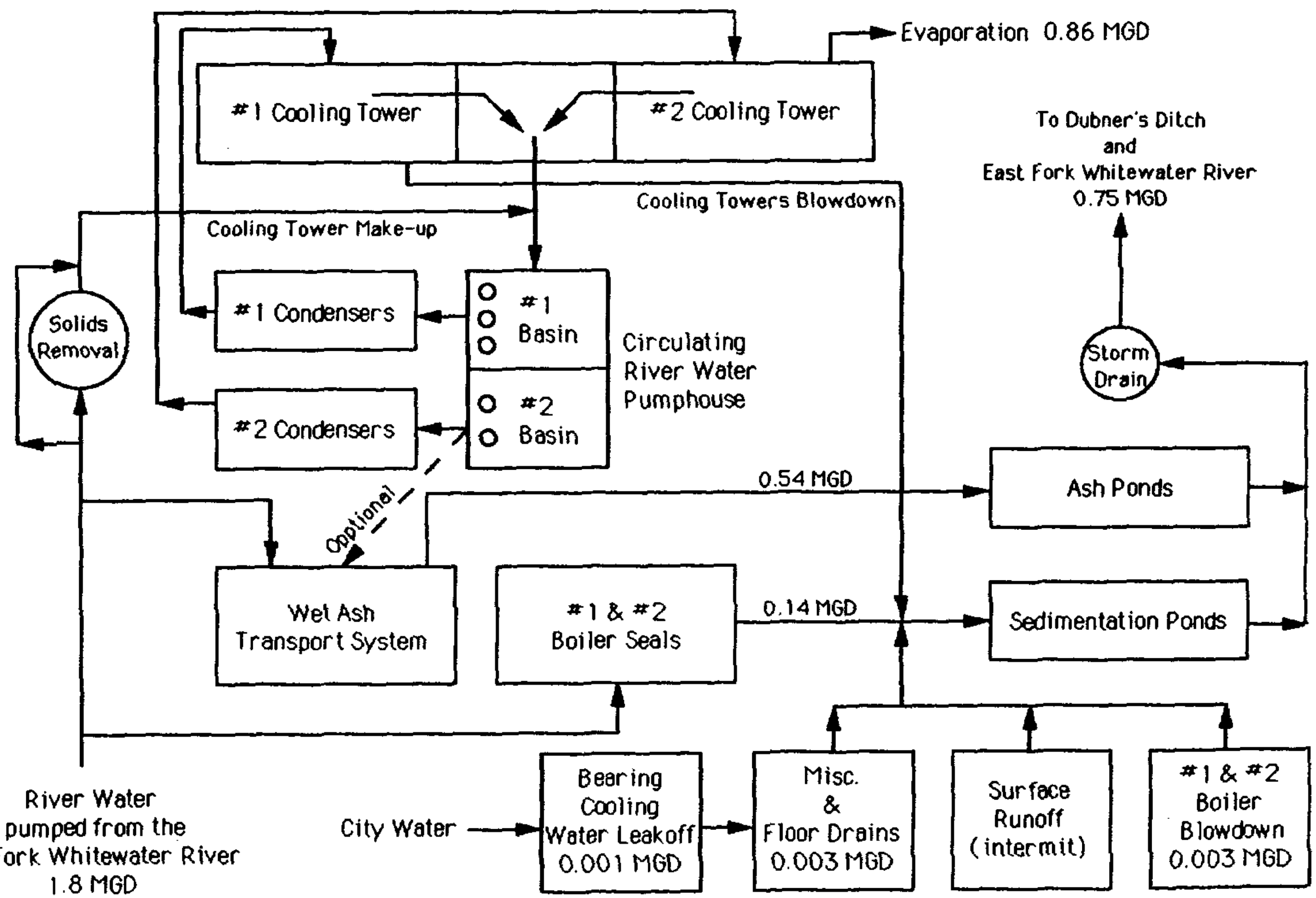


FIGURE 2-7
TYPICAL
WHITEWATER VALLEY UNIT 2
HOURLY BASELINE MASS BALANCE
(MAXIMUM CAPACITY)

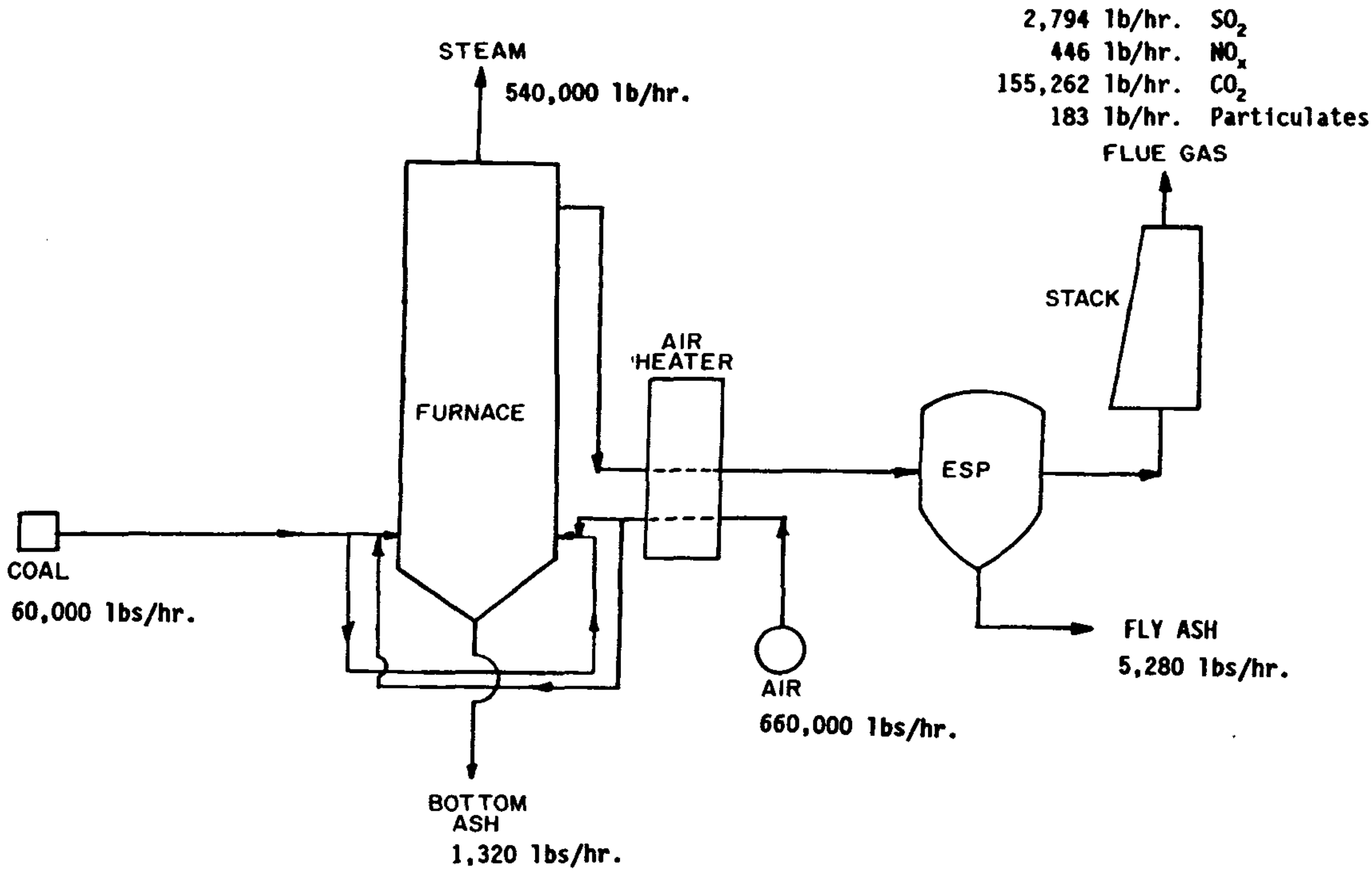
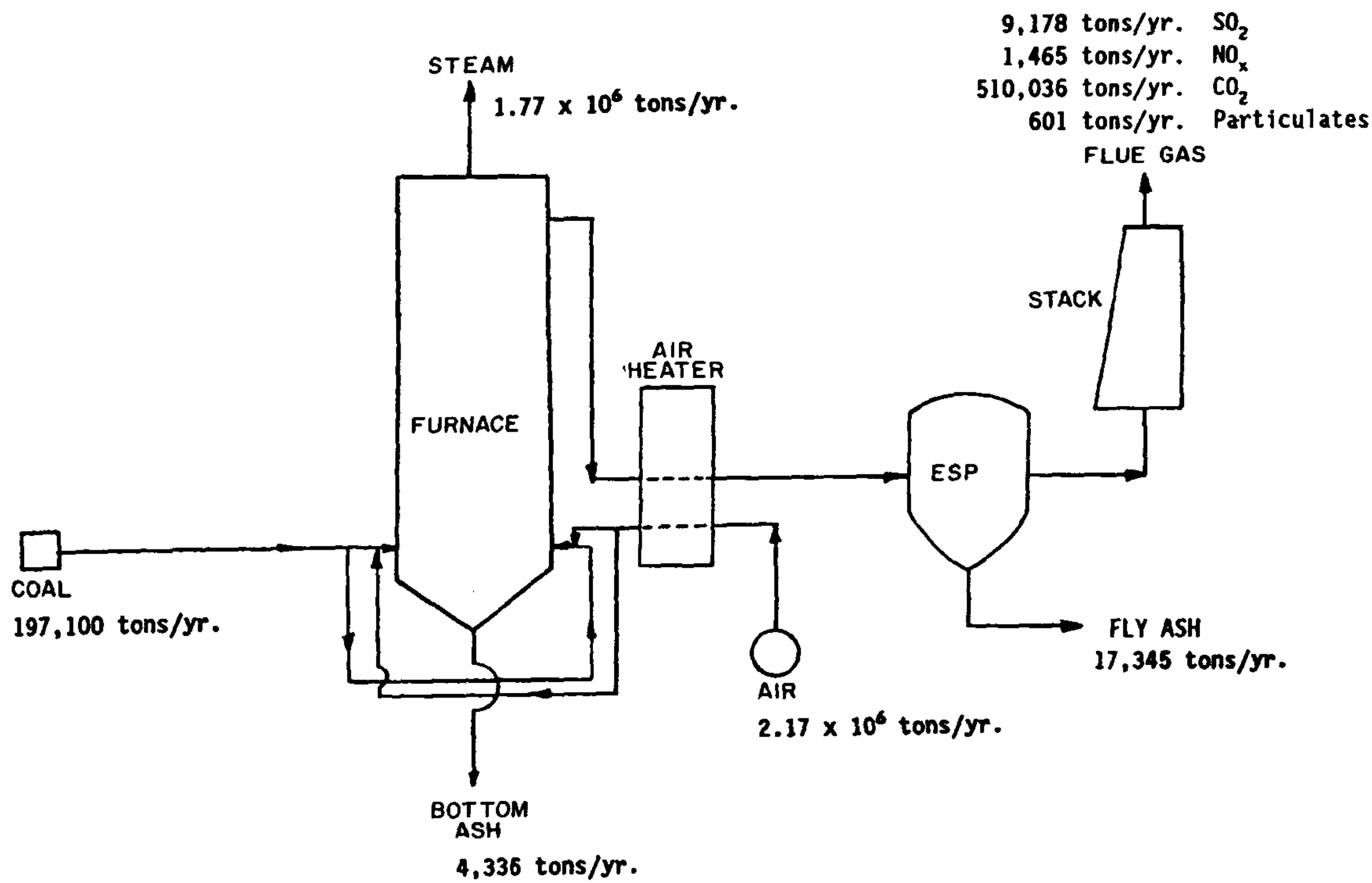


FIGURE 2-8
TYPICAL
WHITEWATER VALLEY UNIT 2
YEARLY BASELINE MASS BALANCE
(75% CAPACITY)



powerplants starting in 1993. Since 1984, Tampella has performed laboratory tests, pilot-scale testing and full-scale testing on utility sized powerplants in developing this technology. LIFAC has been in operation at the Inkoo 250 MW powerplant outside Helsinki for the last two years. This experience has led the substantial refinement and maturation of the LIFAC design, this demonstration project and a vision of future commercial applications.

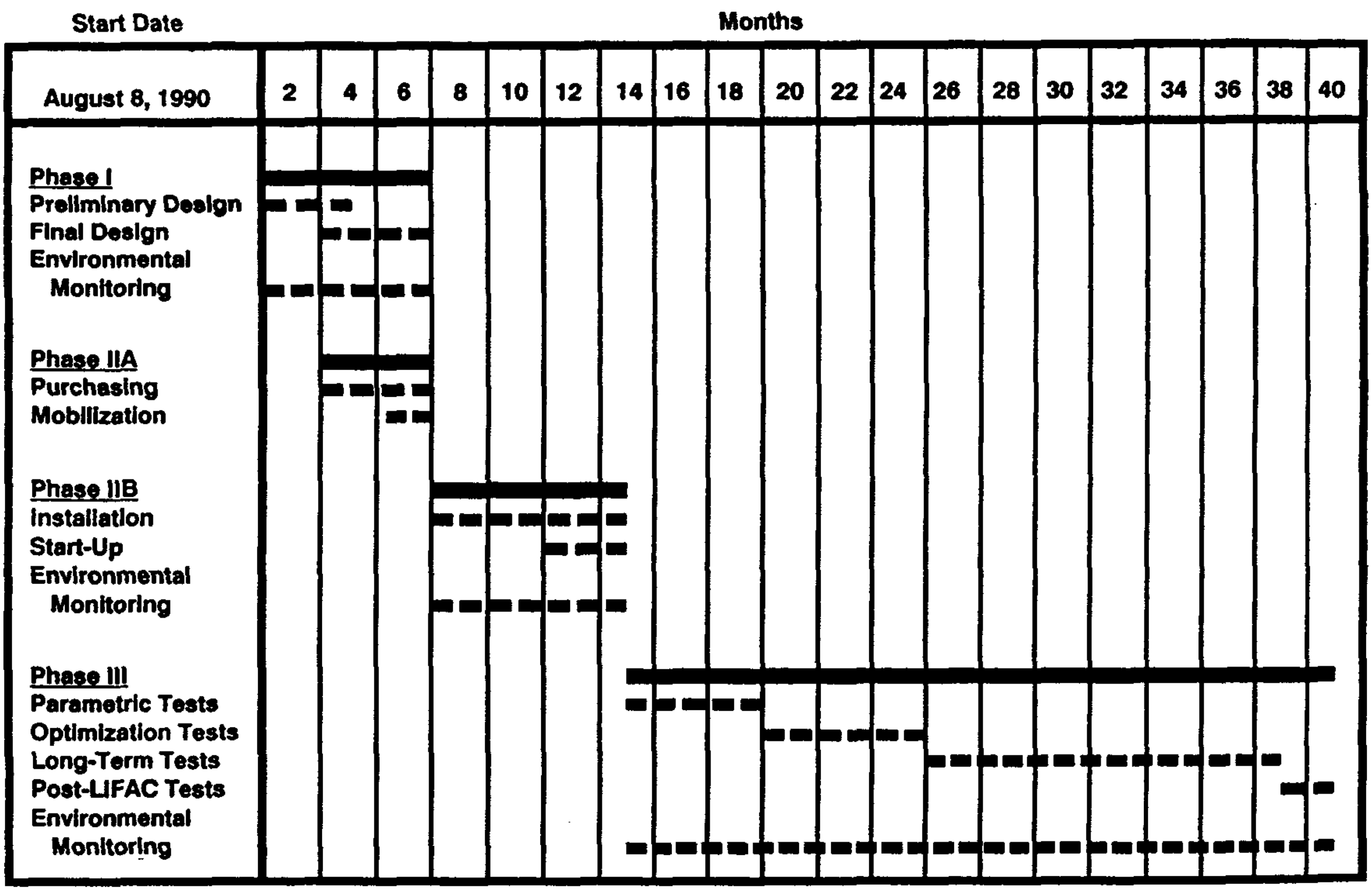
2.1.3.1 Description of Project Phases

The project will be divided into three phases as per the instructions in the Program Opportunity Notice (PON): design, construction and operation. Each phase is broken down into three tasks and numerous subtasks. Each phase has a management and administrative task, including coordination with the Department of Energy (DOE) and the demonstration team members, a technical task and an environmental task. The proposed project schedule including all phases is illustrated in Figure 2-9, the complete Statement of Work for the demonstration has been included as Appendix D and a synopsis of each phase follows.

Design Phase

The design phase will begin August 8, 1990 and will require six months to complete. The project management and administrative task will include documentation of baseline Financial Assistance Reports, Project Evaluation Plans and Project Management Plans. Technical Progress/Review meetings will be held and a comprehensive technology transfer will take place. The technical task will include the evaluation of the present operations at RP&L, a preliminary design phase and a detailed design phase. The preliminary design phase will culminate in a publicly available Preliminary Design Report and a technical progress meeting. The detailed design phase will culminate in a Detailed Design Report which will include a revised cost estimate. During detailed design, the construction drawings, equipment and specifications will be produced. The work will include modifications to the existing Whitewater Valley Generating Station in which there are site-specific space and operational limitations. A constructability review will be implemented to address these issues and produce a design that accommodates the planned construction sequence

Figure 2-9
Project Schedule



and methods with little disruption to the operation of the facility. The following site-specific issues will be addressed during the design phase:

- Sorbent Injection System - Whitewater Valley presently has a sorbent injection system in place that was used during the Electric Power Research Institute (EPRI)/Environmental Protection Agency (EPA) Limestone Injection Multistage Burner (LIMB) demonstration conducted at the site. By start-up of the LIFAC demonstration, the system will have been transferred to RP&L ownership. RP&L is committed to contributing this equipment to support the LIFAC demonstration project. A full assessment must be made regarding the extent to which this system can be used, but at this time, only the addition of a larger limestone storage silo is anticipated. The new larger silo would feed the present silo which in turn will introduce limestone to the furnace.

- Humidification System - Whitewater Valley also has in place the humidification system that was used during the EPRI/EPA LIMB demonstration. By start-up of the LIFAC demonstration, this system will also be transferred to RP&L ownership. RP&L is committed to contributing this equipment to support the LIFAC demonstration project. A full assessment must be made regarding the extent to which this system can be used.

- Recirculation - Material collected from the ESP hoppers will contain some calcium hydroxide and calcium oxide that can be reinjected into the flue gas stream. Recirculation of the slag can lead to a decrease in the amount of limestone used through more efficient use of the sorbent. This would lower the required calcium to sulfur molar ratios. Recirculation is a new feature for the LIFAC process and tests are currently being conducted by Tampella in Finland. Recirculation would further reduce environmental impacts of the demonstration by decreasing the total volume of limestone injected, reducing the loading on the ESP, lowering waste volumes and producing a waste composed of less unreacted material. The results of these tests may be incorporated into Whitewater Valley design work; however, for the analysis in this EIV, no recirculation has been assumed.

- Reheat - Currently, gas entering the Unit 2 ESP is about 285 °F; however, when the gas travels through the activation chamber during the LIFAC demonstration, this temperature will drop to 170-180 °F. To protect the ESP from condensation or corrosion the gas will be reheated to ensure the temperature stays 20-30 degrees above the dew point. Design effort will be made to tailor the reheat system to Whitewater Valley's configuration. One option is to divert turbine steam to a heat exchanger to thus heat gases exiting the activation chamber prior to the ESP. Another option is to bypass some flue gas exiting the air preheater to the ESP inlet.

- ESP - Injection of sorbent into the furnace will increase the mass flow rate of the system from 668,000 lbs/hour to 811,000 lbs/hour. However, gas volume to the ESP will drop from 227,000 cfm to 185,000-200,000 cfm. During the LIMB demonstration, injection of sorbent into the system caused the ESP controls to reduce secondary voltages, especially in the inlet field, causing the opacity to reach unacceptable levels. However, when sorbent injection is performed in conjunction with humidification, the ESP operated efficiently at increased power levels. A continuous operation of 29 hours was performed using injection and humidification, during which no adverse effect on ESP performance was observed. The current rated ESP efficiency is 99.9%, during LIFAC operation the efficiency is expected to range between 98.7% and 99.1%. ESP upgrades, if any, will be minor, e.g. insulation improvements.

- Induced Draft (ID) Fan - The impact of the activation chamber and connecting inlet and outlet ductwork on ID Fan requirements will be assessed in detail.

- Waste Disposal - The current wet handling system for fly ash will be replaced by a dry system to make it compatible with the LIFAC technology. This conversion and other waste issues, including potential use of LIFAC waste as building material, will be further investigated.

The environmental task will include development of the Environmental Monitoring Plan, collection of baseline data and acquisition of all necessary federal, state and local permits or approvals.

Construction Phase

This phase of the project will overlap the last four months of the design phase and then continue an additional seven months to completion. The management and administrative task will include the long term procurement activities of purchasing, subcontracting and mobilization. These will facilitate completion of the detailed design work and will lead to the technical task which includes construction and modification activities, including:

- Injection System - Much of the required sorbent injection system is already in-place, remaining from the LIMB demonstration project. However, a new larger limestone storage silo will be added, and allowance has been made for changes in the placement of the sorbent injection nozzles.

- Activation Chamber - In addition to the actual construction of the activation chamber, there will also be construction of the humidification system, installation of the nozzle (atomizer) section, construction of the ash handling system for reactor bottom ash, construction of the reheat system and construction of inlet and outlet ducts.

- Electrical, Instrumentation and Control - Most of these systems including control software will be purchased from Tampella.

- Fly Ash Handling System - The present 6-inch hydroveyor fly ash exhauster handling and conveyance system will be converted from a wet to a dry mechanical exhauster system.

The technical task will also include the development and implementation of a detailed Test Plan. The Test Plan will be designed to evaluate the effects of changes in process variables and system design parameters. The environmental task will consist of data collection focusing on worker health and safety during construction and a comparison of this data to baseline data collected during the design phase.

Operation Phase

This phase of the project is scheduled to last 26 months and begin in September 1991. The technical phase will consist of 2800 hours of operational testing. The testing program will include plans for parametric and longer duration optimization tests and studies of the process ash and its handling. Toward the end of the operation phase, LIFAC-North America will prepare drafts of final reports for a final technical progress meeting. These draft reports, the Final Technical Report, the Technology Performance Report and the Economic and Evaluation Report, will summarize the results of the demonstration and lay the foundation for further potential process improvements and, hopefully, an aggressive and successful commercialization program. The management and administrative task will report the latest financial information and continue the technology transfer initiated in the Design Phase. Coordination of the project participants will also be continued in this task. The environmental task will continue to monitor appropriate operating and environmental data to assess the environmental and health impacts/benefits of the LIFAC technology

2.1.3.2 Description of Installation Activities

This subsection provides a closer look at the Construction Phase, describing installation and modification work at Unit 2 of the Whitewater Valley generating station.

Limestone Injection System

The limestone injection system pneumatically delivers pulverized limestone into the upper part of the furnace near the superheaters, where capture of some of the SO_2 in the boiler flue gas occurs. Normally this system consists of the following equipment:

- Limestone storage and feeder silos
- Blowers
- Transport air piping and supports
- Injection piping
- Compressed air piping for secondary air

- Compressed air blower
- Injection nozzles
- Containment building for limestone feeding equipment

Whitewater Valley Unit 2 is equipped with 21 access ports suitable for use with an in-furnace sorbent injection system. The access ports were installed during the LIMB demonstration conducted by Energy and Environmental Research Corporation (EERC). This system will be owned by RP&L at the start of the LIFAC demonstration, and its use will be donated by RP&L for the project. The system is located on the side of the building opposite from the stack and activation chamber and includes a storage silo, blowers, pumps, compressors, pipes and nozzles with secondary air injection. As previously mentioned, a new larger limestone storage silo will be needed to accommodate the demonstration. The present bin holds 30 hours worth of limestone, while the new bin will hold an additional 75 hours, for a total of 105 hours.

Limestone will be pulverized off-site, hauled to RP&L and transferred pneumatically to the new storage silo. This approach alleviates the need for materials handling equipment (i.e.,limestone pulverizer) at the site. Screw feeders will be used to transfer the limestone from the new silo to the existing silo and finally to high-speed pumps for delivery of the material into a pneumatic conveying line. The solids pump forces the sorbent through a check valve which prevents back flow of air from the conveying line. Sorbent passes through a series of flow splitters as it is pneumatically conveyed from the solids pump to the injection ports through a series of pipes. These splitters distribute the material to various injection locations in the boiler. Additional air is supplied at the injectors to increase the sorbent flow to the necessary injection velocity. Air for transport and injection is supplied from two independent positive displacement blowers with variable speed drives. This method provides smooth sorbent flow and better system control.

Activation Chamber

The activation chamber is a vertical elongation of the ductwork between the air preheater and the ESP. Flue gas is humidified within the chamber initiating further sulfur capture.

The activation chamber will be located next to the boiler building near Unit 2. As such, it will be next to the new stack and near the forced draft (FD) fan inlet located on the boiler building wall (see Figures 2-10, 2-11, 2-12 and 2-13). The activation chamber's connection to the flue gas stream will be downstream from the air preheater. The hook-in will occur at a short vertical duct which conveys the gas from the air preheater to ductwork which twists upward and feeds the ESP on the roof. The activation chamber inlet duct with control damper will exit the boiler building traveling parallel to the ground and perpendicular to the post-air preheater duct. The inlet will exit the building and enter the activation chamber. Similarly, the outlet duct from the activation chamber will return through the boiler building wall and connect with the post air-preheater duct adjacent to the inlet connection. The placement of and connections for the activation chamber were influenced by the powerplant and site layout. In many newer powerplants the ESPs are located closer to the ground between the boiler building and the stack. At these powerplants, designers would attempt to place the activation chamber next to the ducts feeding the ESPs.

The activation chamber for Unit 2 at Whitewater Valley will be 45 meters high (148 feet) and will have a rectangular cross-section of five by ten meters (16 x 33 feet). The dimensions of the chamber will vary with wider gas passes in the space after the humidification zone. Except for the nozzle sections, there will be no internals such as vanes. The walls will be insulated and mechanical vibrators will be attached. A bottom hopper will be included below each turn to collect slag material. Flight conveyors will move the slag to an intermediate depot silo. Crushers will be installed on the conveyors to prepare the slag for loading onto trucks. A rod unloader will move the slag to a humidification screw where water will be sprayed into the screw for dust protection. The slag will leave the humidification screw and unload into a truck.

System Instrumentation and Controls

A centralized integrated computer-based system with measurement instrumentation, control equipment and automated control capabilities accompanies LIFAC. Instrumentation from the LIMB project is still in place at Whitewater Valley, but the extent to which it will be utilized, if at all, is not known at this time.

FIGURE 2-10
LIFAC INSTALLATION AT WHITEWATER VALLEY
SOUTHERN VIEW

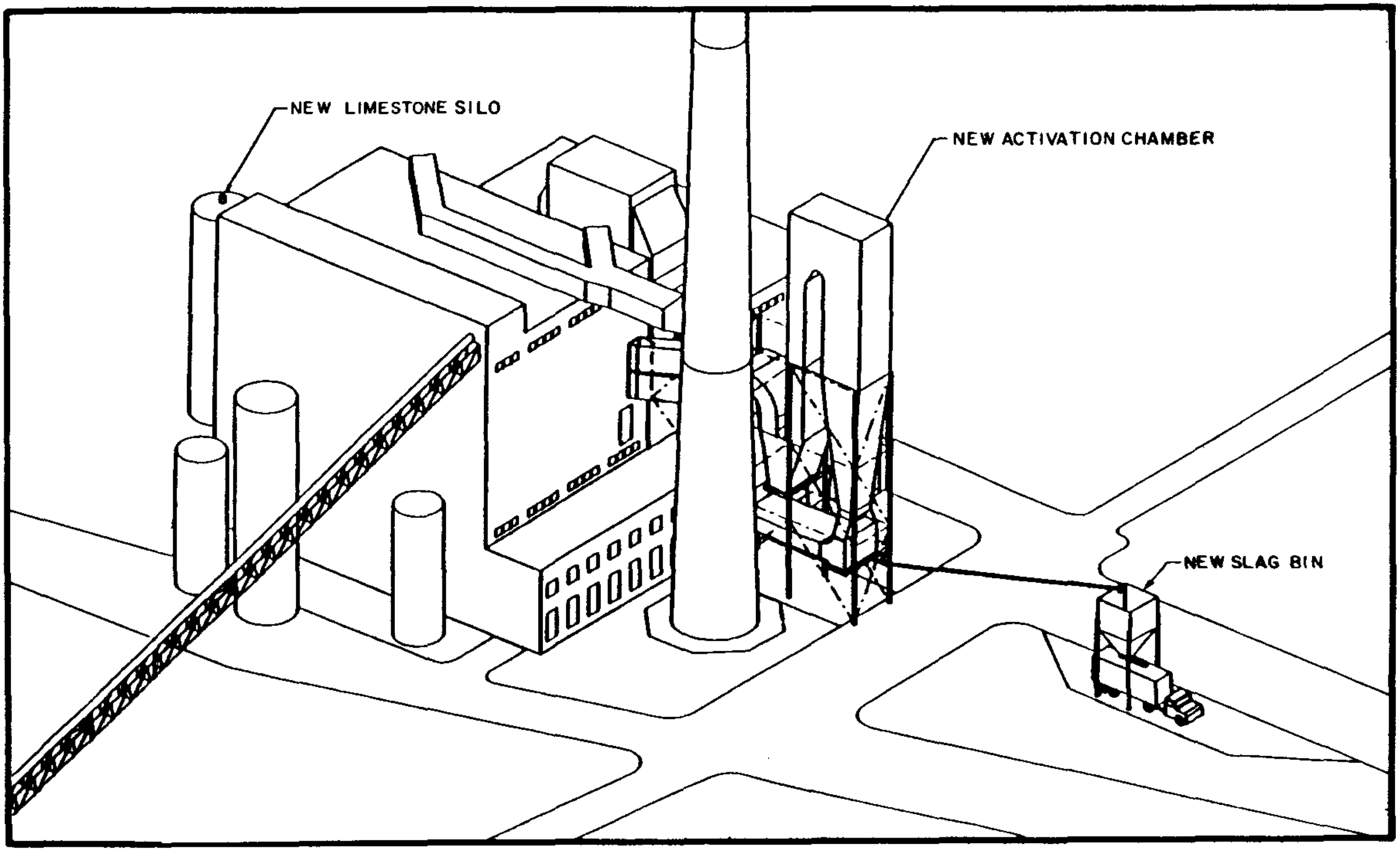


FIGURE 2-11
LIFAC INSTALLATION AT WHITEWATER VALLEY
NORTHERN VIEW

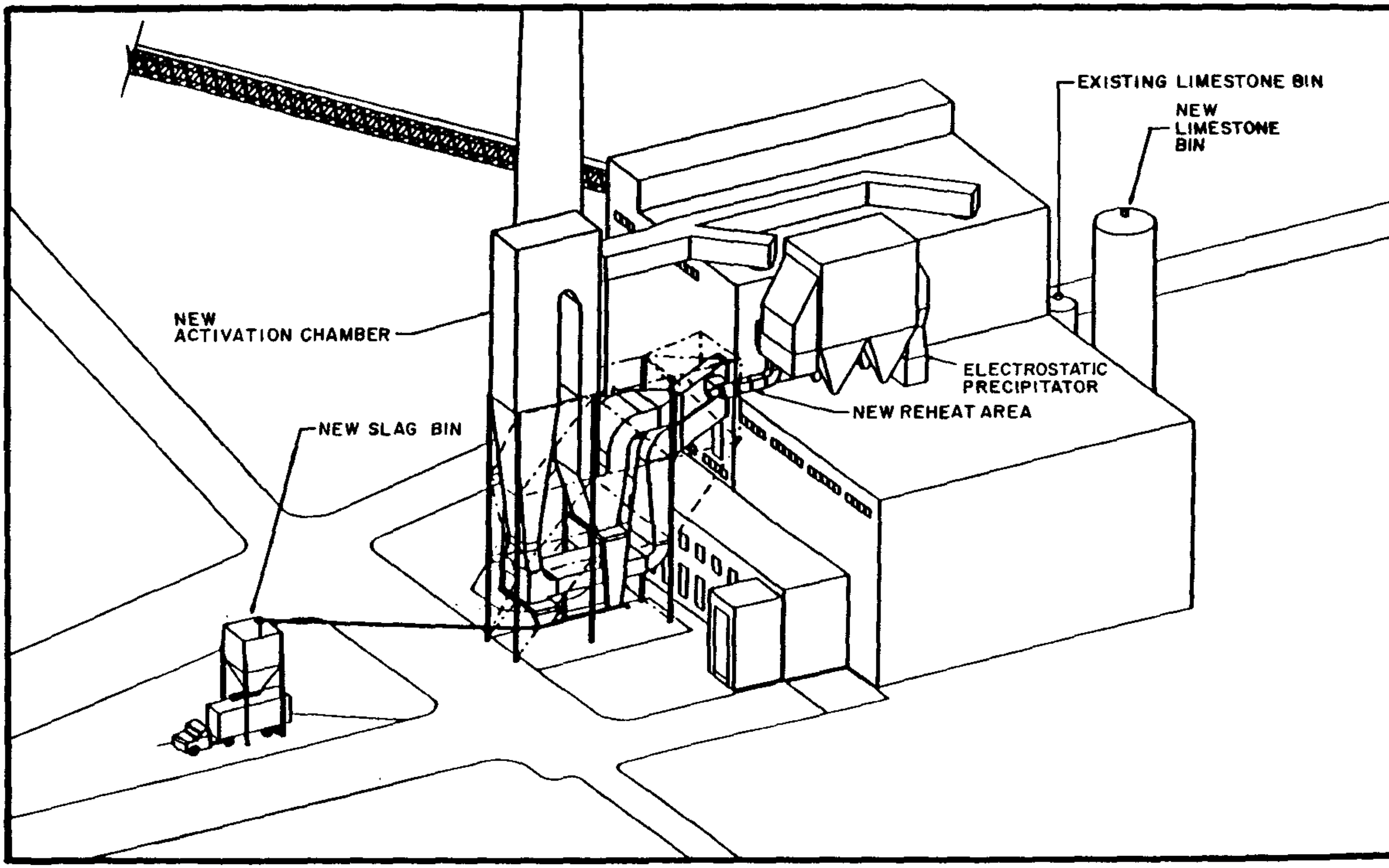


FIGURE 2-12
LIFAC ACTIVATION CHAMBER
WHITEWATER VALLEY
DUCT TIE-IN

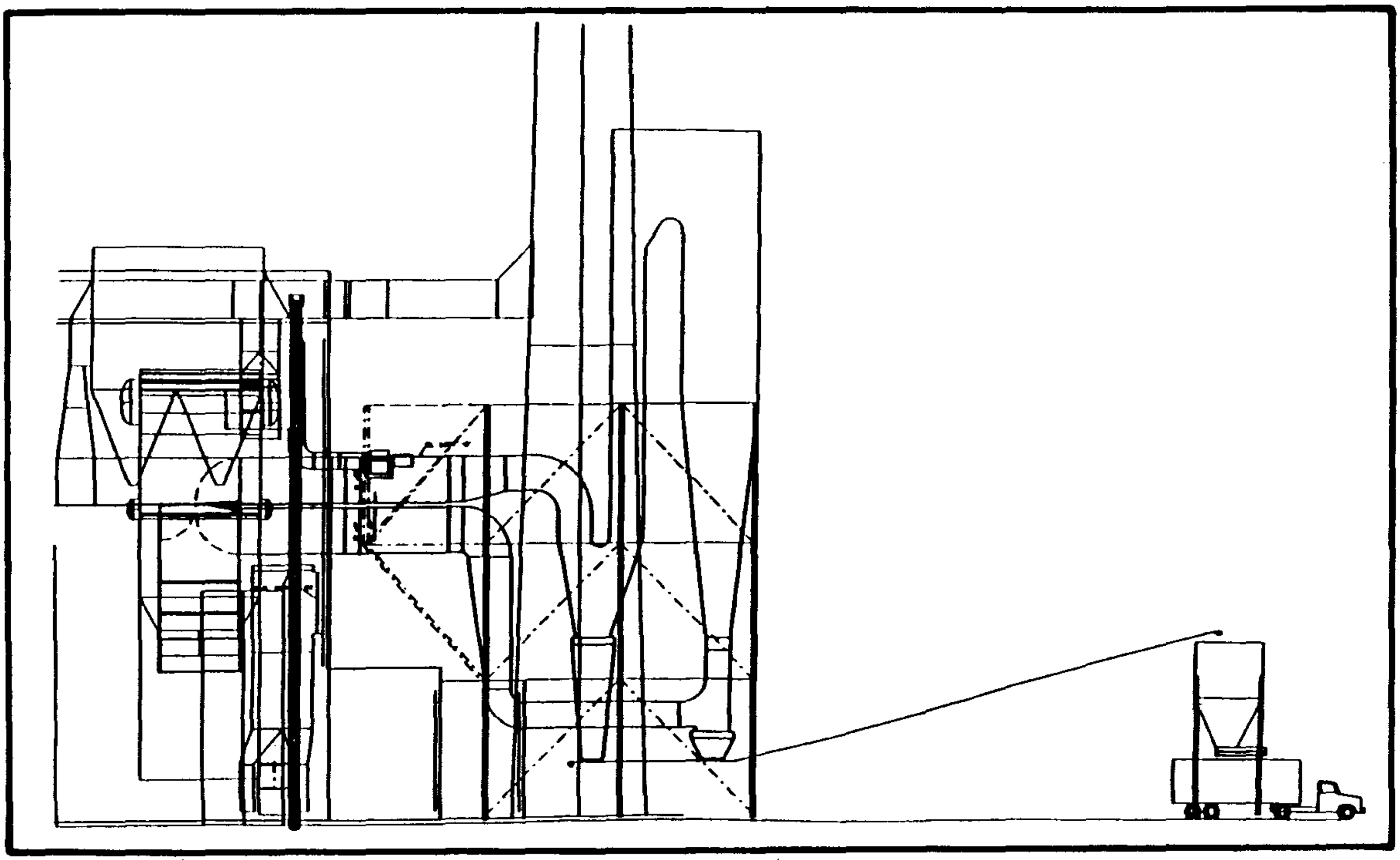
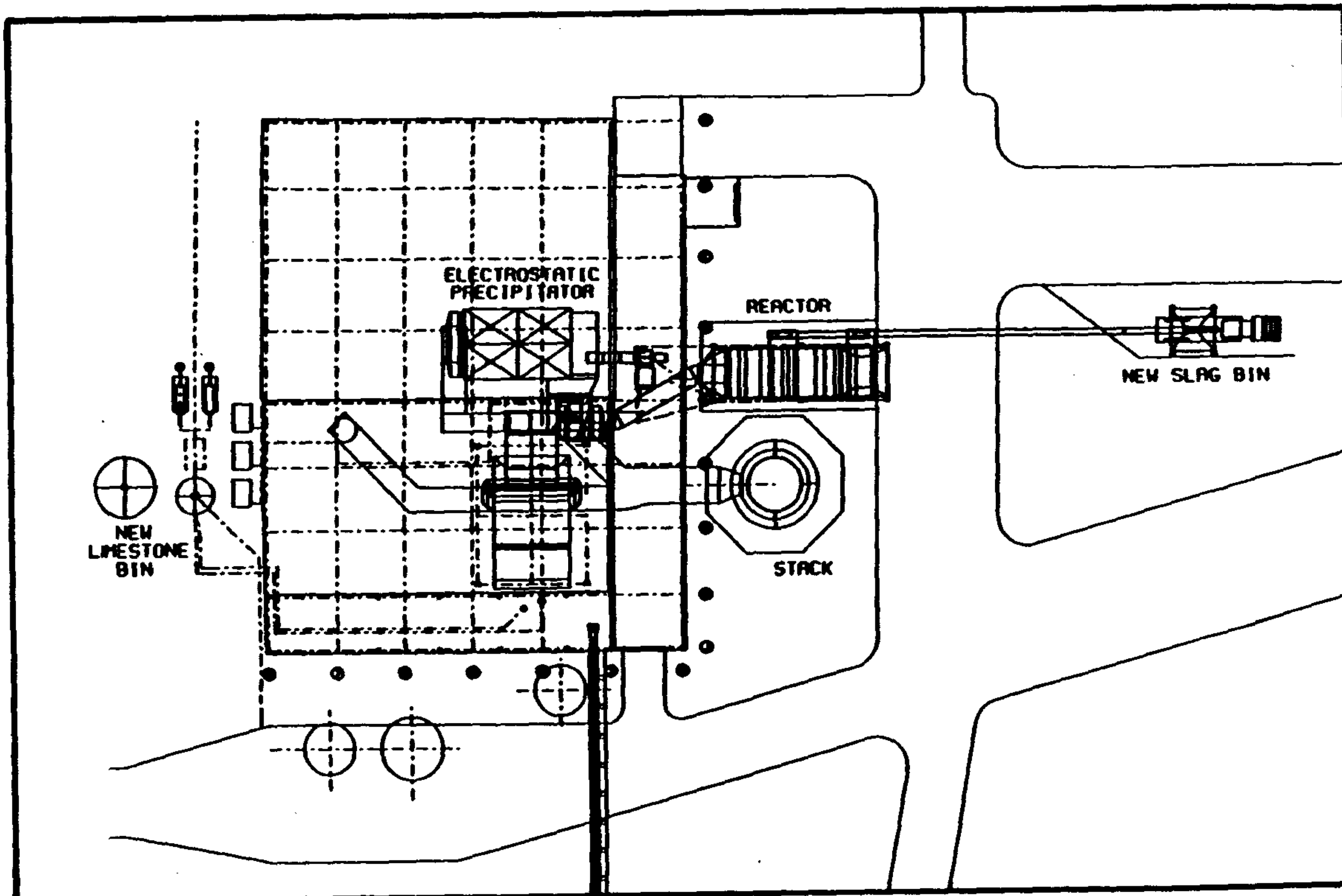


FIGURE 2-13
LIFAC WHITEWATER VALLEY
TOPVIEW



Ash Handling System

The present 6-inch hydroveyor (wet) fly ash conveyance system, which moves ash from the ESP and economizer to a holding silo, will be converted to a dry mechanical exhauster system. The wet system will be retained as a back-up to the dry system but will only be used as a back-up when LIFAC is not in use. If the dry system fails during the LIFAC demonstration, the demonstration will cease until the problem can repaired.

2.1.3.3 Project Source Terms

This subsection profiles the LIFAC project resource requirements, which include energy, land, water, labor, materials and transportation. Figures 2-14 and 2-15 detail LIFAC flow rates for hourly full-load and annualized operation, respectively. In Table 2-5, the material volumes associated with 2800 hours of baseline full-load operation of Unit 2 are compared to volumes which will be generated in the 2800 hours of the LIFAC demonstration. The resources associated with the LIFAC demonstration project are discussed in the following sections.

Energy Requirements

Energy requirements associated with the LIFAC demonstration include coal and electrical power. The coal choice for the demonstration has not been finalized at this time but will be assumed to have similar characteristics to the coal described in Table 2-1. The electric power required to operate the limestone injection system, dry fly ash collection system, conveyors, crushers for activation chamber waste handling, monitors and system controls will be drawn directly from the powerplant.

The additional electric energy requirements and the introduction of limestone into the boiler will reduce the net output of Unit 2 slightly. LIFAC is expected to drop the rated capacity from 60 MW to 59.5 MW. If this loss in output must be made-up, more power can be generated by another source within the associated power grid. The integrated nature of the RP&L system makes this possible.

FIGURE 2-14
TYPICAL
WHITEWATER VALLEY UNIT 2
HOURLY LIFAC MASS BALANCE
(MAXIMUM CAPACITY)

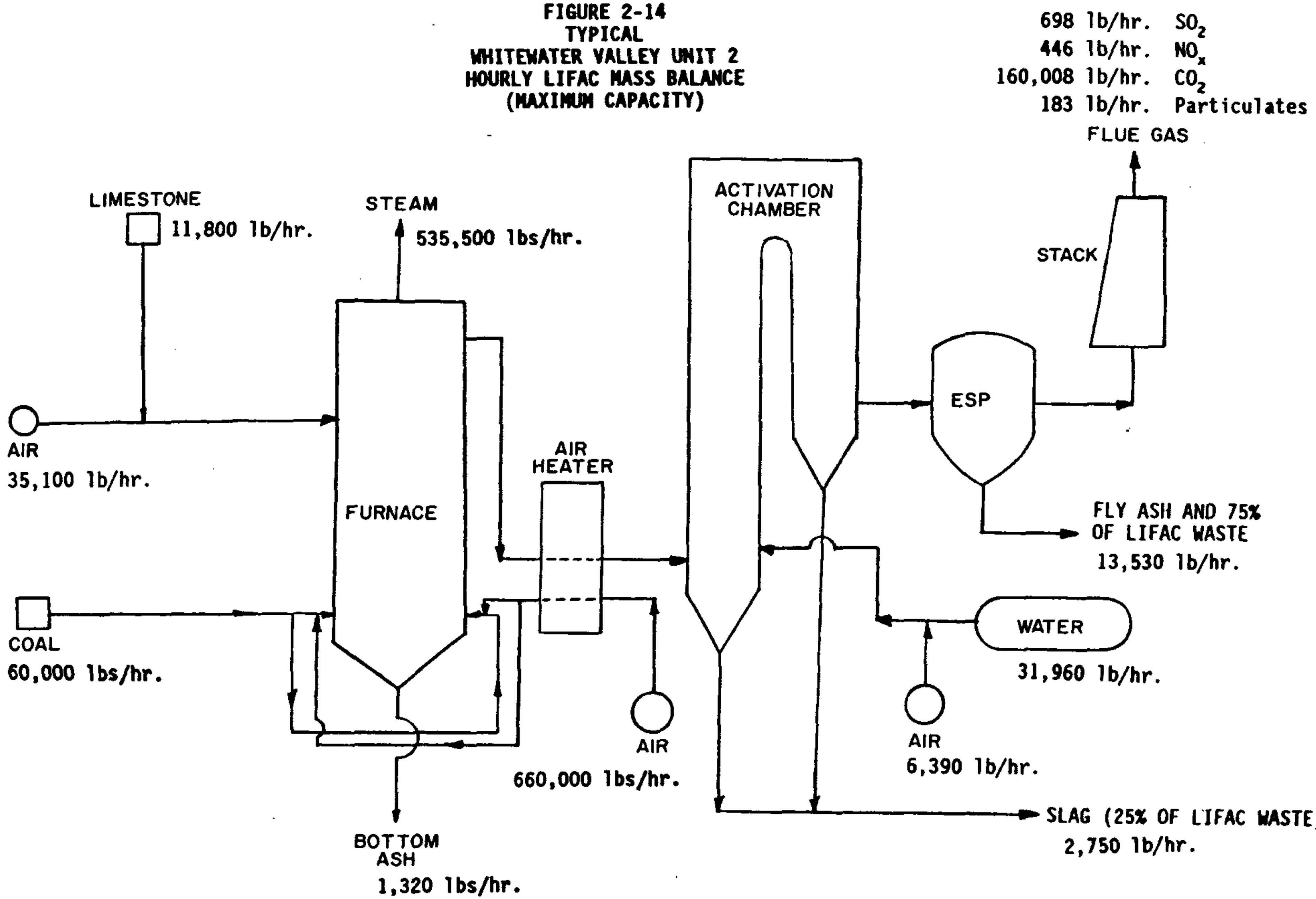


FIGURE 2-15
TYPICAL
WHITEWATER VALLEY UNIT 2
YEARLY LIFAC MASS BALANCE
(75% CAPACITY)

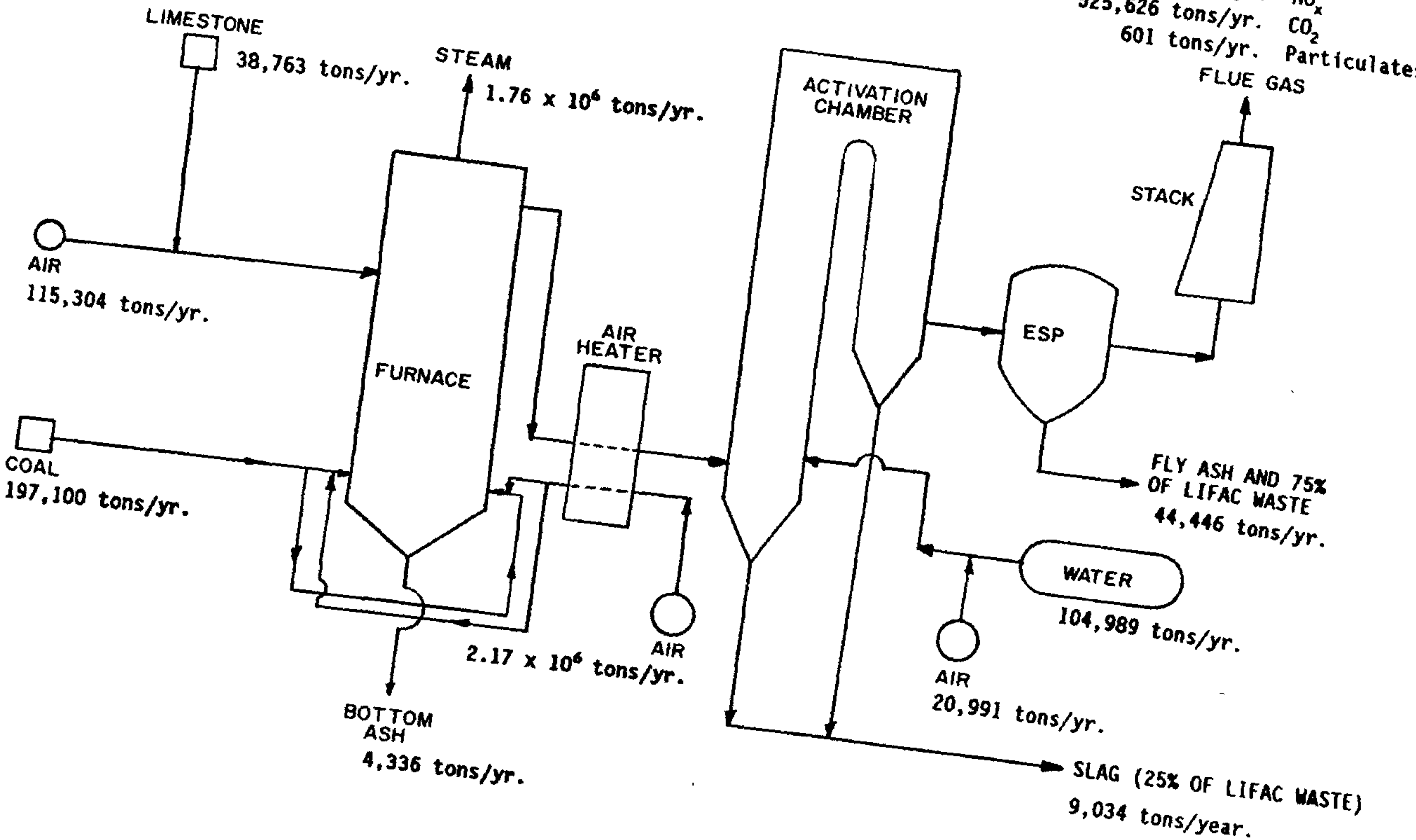


TABLE 2-5

TOTAL MATERIAL VOLUMES FOR LIFAC
2800 HOUR DEMONSTRATION[1]
vs
TOTAL MATERIAL VOLUMES FOR
BASELINE OPERATION OVER A 2800
HOUR PERIOD[1]

	2800 hrs Baseline (tons)	2800 hrs LIFAC (tons)
Input Streams		
Coal	84,000	84,000
Limestone	0	16,520
Air	924,000	982,086
Water	2,878-3,587	851-1,560
Output Streams		
Steam	756,000	749,700
Bottom Ash	1,848	1,848
Fly Ash[2]	7,392	18,942
Slag[3]	0	3,850
Flue Gas		
SO_2	3,912	977
NO_x	624	624
CO_2	217,367	224,011
Particulate	256	256

1 Full Load Operating Capacity
2 For LIFAC, this stream is fly ash + 75% of LIFAC waste
3 For LIFAC, this stream is 25% of LIFAC waste

Land Requirements

The LIFAC technology demonstration involves the retrofit of process components on the existing boiler; therefore, installation will require no additional land beyond the existing plant boundaries. The new limestone silo, activation chamber, activation chamber collection system and holding silo will be situated on RP&L property just outside the powerplant structure. Other components of the LIFAC process, e.g., limestone injection system, will be contained within the existing boiler structure.

An increased volume of solid waste will be produced by Unit 2 when the LIFAC technology is applied; therefore, a greater landfill volume will be required for its disposal. Under full-load baseline operation, 3.3 tons of fly and bottom ash are produced each hour. The combined ashes have a density of 70 pounds per cubic foot which corresponds to a landfill volume of 3.5 cubic yards per hour. With LIFAC in operation, 8.14 tons of LIFAC waste and fly ash mixed with LIFAC waste and 0.66 tons of bottom ash will be produced each hour. Before landfilling the solids containing LIFAC waste will need to be hydrated to 23% water. The density of the hydrated material will be approximately 86 pounds per cubic foot and the bottom ash density will remain at 70 pounds per cubic foot. Subsequently, the hydrated solids will require 8.6 cubic yards of landfill space per hour and the bottom ash will require 0.70 cubic yards of space per hour. The combined 9.3 cubic yards of landfill space required each hour (26,040 cubic yards for 2800 hour demonstration period) represents about a 166% increase in landfill space over baseline operation.

The LIFAC waste will be transported to a permitted off-site landfill for disposal in compliance with IDEM regulations. Candidate landfills include:

- An IDEM approved and permitted landfill owned and operated by RP&L in a yet to be identified location. Currently, RP&L utilizes a quarry it owns located about 2 miles from the powerplant. This source will be filled prior to the start of LIFAC and will therefore not be available.

- The city of Richmond Municipal Landfill located within 6 miles of plant. The landfill has 1-2 years of useful life remaining but the construction of new cells is already underway. The new cells will cover 40-45 acres, have an expected lifetime of 18 years and should be operational prior to demonstration start-up. The landfill is currently permitted to accept solid waste but could only accept LIFAC waste with approval by IDEM. Similar approval was passed by IDEM for LIMB waste in the past. The LIMB waste was mixed with sewage sludge from the municipal wastewater treatment plant and blended into the municipal waste. Currently, the landfill receives approximately 375 tons or 625 cubic yards of waste each day (McQuire, 1990). If Richmond were to accept all of the solid LIFAC waste, the landfills expected lifetime would be reduced by approximately 42 days. LIFAC waste would represent 0.64% of the landfills future fill volume.

- The Randolph Farms Landfill located in Modoc, Indiana is within 30 miles of plant and permitted to accept solid and special waste. The landfill covers 120 acres and has an estimated useful life of 15 years. About 2000 cubic yards of waste is accepted each day and buried in 4-6 foot lifts (Fine, 1990). Accepting all of the solid waste from the LIFAC project would reduce the useful life of the landfill by approximately 13 days. This would represent only 0.24% of the future fill material.

- The Southside Landfill in Indianapolis, Indiana is within 70 miles of the plant and is permitted to accept solid and special wastes. The 240 acre facility accepts about 5000 cubic yards of waste per day and has a remaining useful life of 15-20 years (Cook, 1990). Accepting all of the solid waste from the LIFAC project would reduce the useful life of the landfill by approximately 5 days. This would represent only 0.09% of the future fill material.

LIFAC waste material generated during the initial start-up period will be accumulated in a covered roll-off box located on-site for analysis according to the Indiana Department of Environmental Management (IDEM) protocols for waste characterization. Information from these analyses will be submitted to candidate landfills to allow documentation of the acceptability of the waste for disposal at the facility and to obtain State approval for waste acceptance. The waste acceptance process commonly takes about 60 days following submission of waste characterization data to the landfill and State. Upon notification of acceptance at a candidate landfill, the roll-off will be transported according to state solid waste regulations to the accepting landfill for disposal. Any LIFAC waste residue remaining in the roll-off will be disposed of properly. LIFAC waste generated after the initial start-up period will be accumulated in plant storage areas, analyzed for chemical characteristics and transported for disposal on a regular basis.

An approximate composition of LIFAC waste, based on experience in Finland is:

- Calcium sulfite 29%
- Calcium sulfate 17%
- Calcium hydroxide 14%
- Calcium carbonate 23%
- Lime (calcium oxide) 17%

Extensive chemical analyses and leaching tests have been performed on LIFAC waste produced at the Inkoo facility in Finland using coal shipped from the United States as fuel. Table 2-6 presents selected results of column and agitation tests done on the waste and Appendix E contains a detailed description of the testing procedures and coal, limestone and waste analyses. The results of the tests performed on the LIFAC waste show that metal values in the leachate are below current Primary regulatory limits for drinking water in the United States. While some secondary drinking water standards are exceeded, these standards are for the control of aesthetic qualities such as taste and odor.

Water Requirements

With the implementation of the new dry ash handling system, the powerplants on-site water needs will decrease. The LIFAC humidification process will require approximately 3,800 gallons per hour when operating; however, this volume will be offset by the reduction in water use provided by the dry ash handling system. Sluice water for bottom ash handling will remain unchanged.

TABLE 2-6

COLUMN AND AGITATION TESTS WITH THE LIFAC WASTE PRODUCT

	SDWA Standards[1]		Column Test[2]	Agitation Test[3]
pH	6.5 - 8.5	P	12.0	12.0
NO_2 (mg/l)	NS		<0.1	<0.1
NO_3 (mg/l as N)	10	P	5	0.8
SO_4 (mg/l)	250	S	350	200
PO_4	NS		<0.1	<0.1
Fe	0.3	S	0.86	0.24
Mn	0.05	S	0.04	<0.04
Cu	1.0	S	0.06	0.01
Pb	0.05	P	<0.05	<0.05
Cd	0.01	P	<0.01	<0.01
Zn	5.0	S	0.12	0.01

1 Safe Drinking Water Act National Primary (P) and Secondary (S) Drinking Water Standards

2 Ratio solution-solids 0.1

3 Ratio solution-solids 1:1

NS No current SDWA standard

Labor Requirements

Labor will be required for installation of the LIFAC equipment and for the operation and maintenance of the system.

Although the installation of LIFAC equipment represents the largest labor requirement (20-25 workers), it is still a relatively small effort that will be managed using locally available labor for both general and specialized skills. Operation and maintenance of the LIFAC system will require 5-8 engineers and operators during the demonstration period. The existing Whitewater Valley operations staff, along with LIFAC-North America test crew personnel, will be able to handle the LIFAC operation and maintenance needs.

Material Requirements

The primary material requirement for the LIFAC demonstration is limestone. During operation, approximately 16,520 tons of limestone will be required. With the addition of the new limestone storage silo, a limestone volume capable of supporting up to 105 operational hours will be stored onsite. Construction materials will be purchased from local distributors, and include: limestone silo, limestone handling equipment, ash bin, ash transport equipment, concrete, piping, hardware, and ductwork. Control equipment will be purchased from Tampella.

Transportation Requirements

The main factors involved in transportation will be increased truck traffic to the plant for the delivery of limestone, and a relative rise in solid waste transported off-site for disposal. Currently, approximately 30 trucks per day delivered coal and remove waste at the plant. During the LIFAC demonstration, 661 trucks delivering limestone and 616 additional trucks leaving for disposal will be added to the current truck traffic at the plant. Based on 2800 hours of LIFAC operation and a test period of 26 months; the additional 1,276 trucks represent a net increase of approximately 1.5 trucks per day. All estimates of truck traffic are made using a truck capacity of 25 tons.

2.1.3.4 Potential EHSS Receptors

The EHSS issues which may be affected by the LIFAC demonstration at the Whitewater Valley 2 Generator are air quality, land use, surface water quality, labor force and energy resources. The principal EHSS impact of LIFAC, other than reducing SO_2 emissions, relates to the creation of the dry waste defined in "Land Requirements", Section 2.1.3.3 of this report. This waste product is relative easy to handle and has potential commercial uses which could reduce landfill requirements and produce revenues. Moreover, existing laboratory testing on LIFAC waste indicates it is not hazardous and is not likely to contaminate water supplies. The existing plant environment is characterized with respect to EHSS features in Section 3.0, and project impacts on each feature are discussed in Section 5.0.

2.2 Alternatives to Proposed Action

This subsection addresses three alternatives to the LIFAC demonstration at Whitewater Valley: no action, the use of alternative technologies and the use of alternative sites.

2.2.1 No Action

The No Action Alternative would result if the planning for the LIFAC demonstration were terminated prior to any modifications of Unit 2. In this case, the baseline plant operation would remain as described in Section 2.1.2 and the existing environment would remain as outlined in Chapter 3.

2.2.2 Alternative Technologies

Other commercially available technologies could be used to reduce SO_2 emissions at Whitewater Valley; however, LIFAC delivers a higher level of removal than in-furnace sorbent injection, and offers a cheaper, more compatible option to conventional scrubbing. Also, the waste stream created during the LIFAC process could potentially be used in many ways, including: cement and construction materials production; filler in the paint and paper industry; and as a bulking material for municipal wastewater treatment sludge. If an alternative technology were chosen, the data and information which this demonstration will provide, would not be realized. The LIFAC technology was chosen because of its potential to improve the environment, while doing so with little interruption or modification to existing facilities.

2.2.3 Alternative Sites

When choosing the host facility, location, configuration, operation, utilization and resource availability were considered. Boilers from the following systems were candidates:

- Central Illinois Public Service
- Pennsylvania Power & Light
- Public Service of Indiana
- Ohio Edison
- Virginia Electric Power

RP&L's Whitewater Generating Station is an ideal candidate site for the following reasons:

- Access - The Whitewater Valley site has good transportation access to many of the nation's leading high sulfur coal areas including the Illinois Basin and Northern Appalachian Basin. Also, Richmond Indiana is the industrial Midwest providing access to labor and materials.

- Sorbent Injection - Whitewater Valley Unit 2 has been the site of a joint USEPA and EPRI sorbent injection demonstration known as the LIMB project. Subsequently, the sorbent injection equipment including silo, feed tubes, pumps and compressors, injection ports and some testing equipment are in place, and RP&L has agreed to contribute this equipment to the LIFAC demonstration.

- High Sulfur Coal - Whitewater Valley consumes high sulfur Indiana coal (2.4-2.9% sulfur) Previous LIFAC tests conducted in Finland have been on lower sulfur coal. Demonstrating LIFAC on high sulfur United States coal is a logical extension of the Finnish work and necessary for LIFAC's commercial success in the United States.

- Boiler - The tangentially-fired boiler is small for its capacity, increasing flue gas flow rates in the boiler and reducing particle residence time. This complicates the demonstration, but success here, in spite of this difficulty, will reinforce the argument that LIFAC can be successfully applied to a variety of boiler types. Also, tangentially-fired boilers inherently reduce NO_x emissions.

- Difficult Retrofit Conditions - Whitewater Valley is a challenging candidate for a retrofit, because the site is more cramped than previous Finnish test sites. A success here will demonstrate LIFAC's broad applicability to the large number of existing United States powerplants likely to have to reduce emission under recently proposed acid rain regulations.

- High Utilization - Whitewater Valley is a heavily utilized powerplant operating in 1988 at a 77% utilization level, far higher than Finnish coal powerplants; therefore, LIFAC will also have an opportunity to demonstrate that it is compatible with typical United States powerplant baseload operations.

- New Landfill - A new lined municipal landfill with an appropriate groundwater monitoring system is currently under construction for the city of Richmond and LIFAC wastes could be conveniently disposed at this site.

SECTION 3.0

EXISTING ENVIRONMENT

3.0 EXISTING ENVIRONMENT

This chapter reviews the environmental features surrounding the Richmond Power and Light Whitewater Valley Unit 2 Generating Station. Emphasis is placed on those features that could be affected by the proposed action.

3.1 Atmospheric Resources

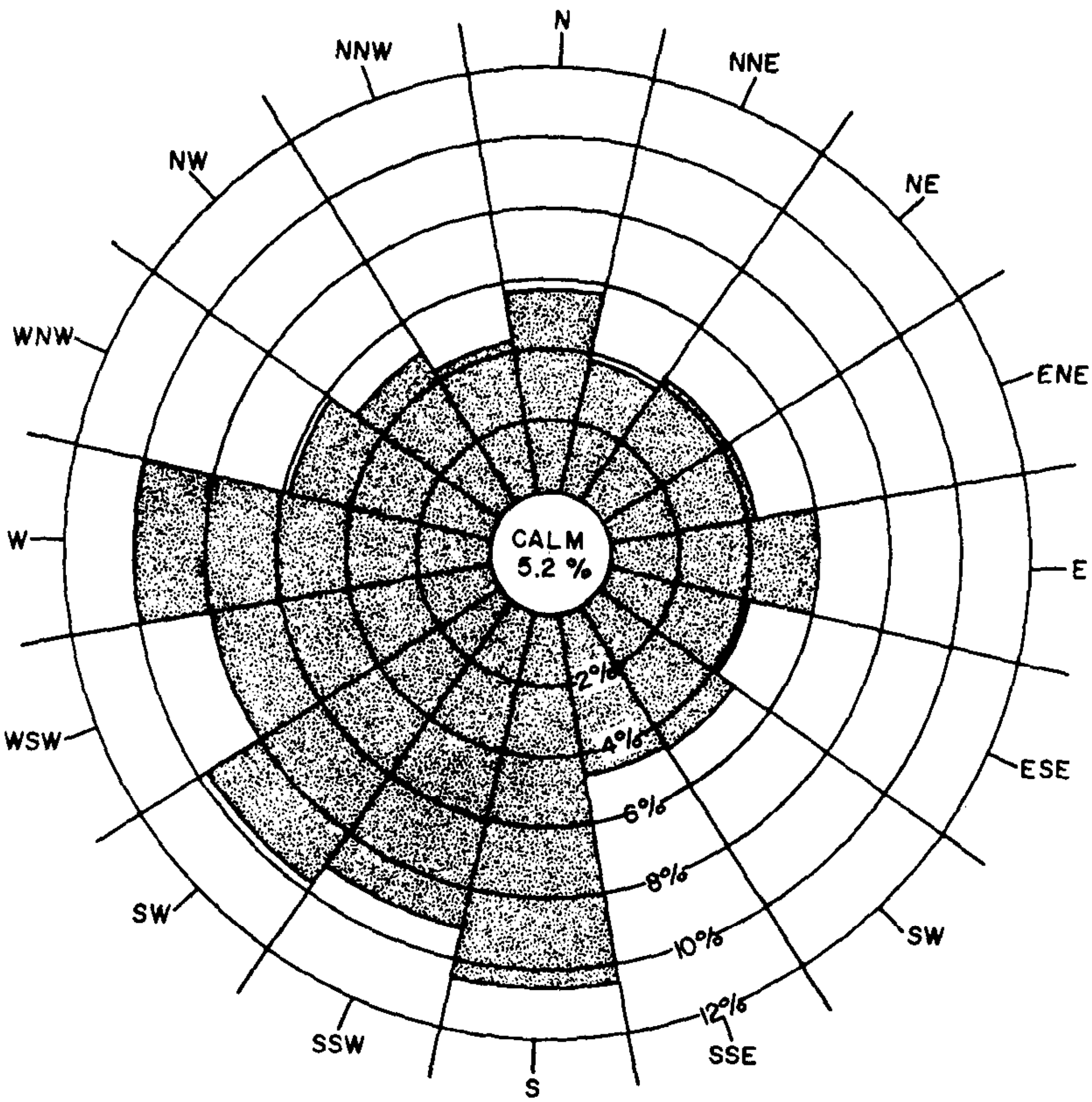
The area of east central Indiana, in which the Whitewater Valley demonstration site is located, provides a typical midwestern climate with warm summers and fairly cold winters. Wind in the region is predominately from the south-southwest with speeds ranging on average from 10-20 knots (Martin, 1986). A wind rose developed with meteorological data from Dayton, Ohio depicting the wind conditions in Richmond is included as Figure 3-1. The average annual precipitation in Richmond is 38.8 inches (NOAA 1978-1988).

Air quality in the Richmond region is generally good. Wayne County is in the East Central Indiana Intrastate Air Quality Control Region (40 CFR 81.315). Air quality control and permitting for the county falls under the jurisdiction of IDEM's Air Pollution Control Board. The area surrounding RP&L is a primary attainment area for the U.S. EPA criteria pollutants: total suspended particulates, ozone, carbon monoxide and nitrogen oxides (NO_x). The area is a primary non-attainment area for SO_2 (40 CFR 81.315). A survey of Wayne County SO_2 emissions in 1986 by Meteorological Evaluation Services (MES), Inc. noted there were 16 sources of SO_2 in the county. Table 3-1 lists the sources, the 1986 emission limits and a proposed limit for each to meet attainment criteria for the county.

3.2 Land Resources

Wayne County encompasses an area of approximately 411 square miles, or 263,000 acres (Wackler, 1990). The northern and southwest quarters of the county lie within the Tipton Till Plain. This physiographic unit is a nearly flat to gently rolling glacial plain, which is virtually featureless throughout much of its area. The plain is crossed by several end moraines, but within

FIGURE 3-1
WIND ROSE



SOURCE: EPA STAR PROGRAM
STATION: DAYTON, OHIO
HEIGHT: 22 FEET AGL
PERIOD: 1982 – 1986

TABLE 3-1

WAYNE COUNTY SOURCE SULFUR DIOXIDE EMISSION LIMITATIONS

($lbs/10^6$ BTU)

Source	1986 Limit	Proposed For Attainment[1] Annual	24-Hour
Richmond Power & Light	6.00	6.00	6.00
Sanyo E&E	6.00	3.92	4.93
Joseph Hill A3	6.00	1.60	1.60
Kemper 1	6.00	1.31	2.30
Kemper 2	6.00	1.25	2.10
Kemper 3	6.00	1.20	1.20
NATCO	6.00	3.71	4.86
Ralston	6.00	1.60	1.60
Earlham	6.00	1.60	1.60
Belden	6.00	1.60	1.60
Johns-Manville B2	6.00	1.60	1.60
Johns-Manville SX23	9 lb/ton	9 lb/ton	9 lb/ton
Joseph Hill A1, 2, 4	6.00	1.60	1.60
Richmond State Hospital	6.00	6.00	6.00
Joseph Hill B	0.30	0.30	0.30
Wallace	6.00	1.60	1.60

[1] Meteorological Evaluation Services, Inc. (See Reference)

the county they are poorly developed and not noted as prominent to the landscape. The southeast quarter of the state lies within the Dearborn Upland unit, which is a plateau region characterized by summit elevations around 1,000 feet above sea level and by deeply-incised streams occupying V-shaped valleys. The entire county was covered with ice during the Illinoisan and Wisconsin glacial periods (Schneider, 1966). The RP&L facility is located in the Dearborn Upland area. A topographic view of the site is included as Figure 3-2.

The Ohio River is approximately 55 miles south of the county. All drainage from the county is carried to the Ohio River through Whitewater River and its East, Middle and West Forks; and Nettle, Martindale, Morgan's, Greensfork, Noland's and Elkhorn Creeks.

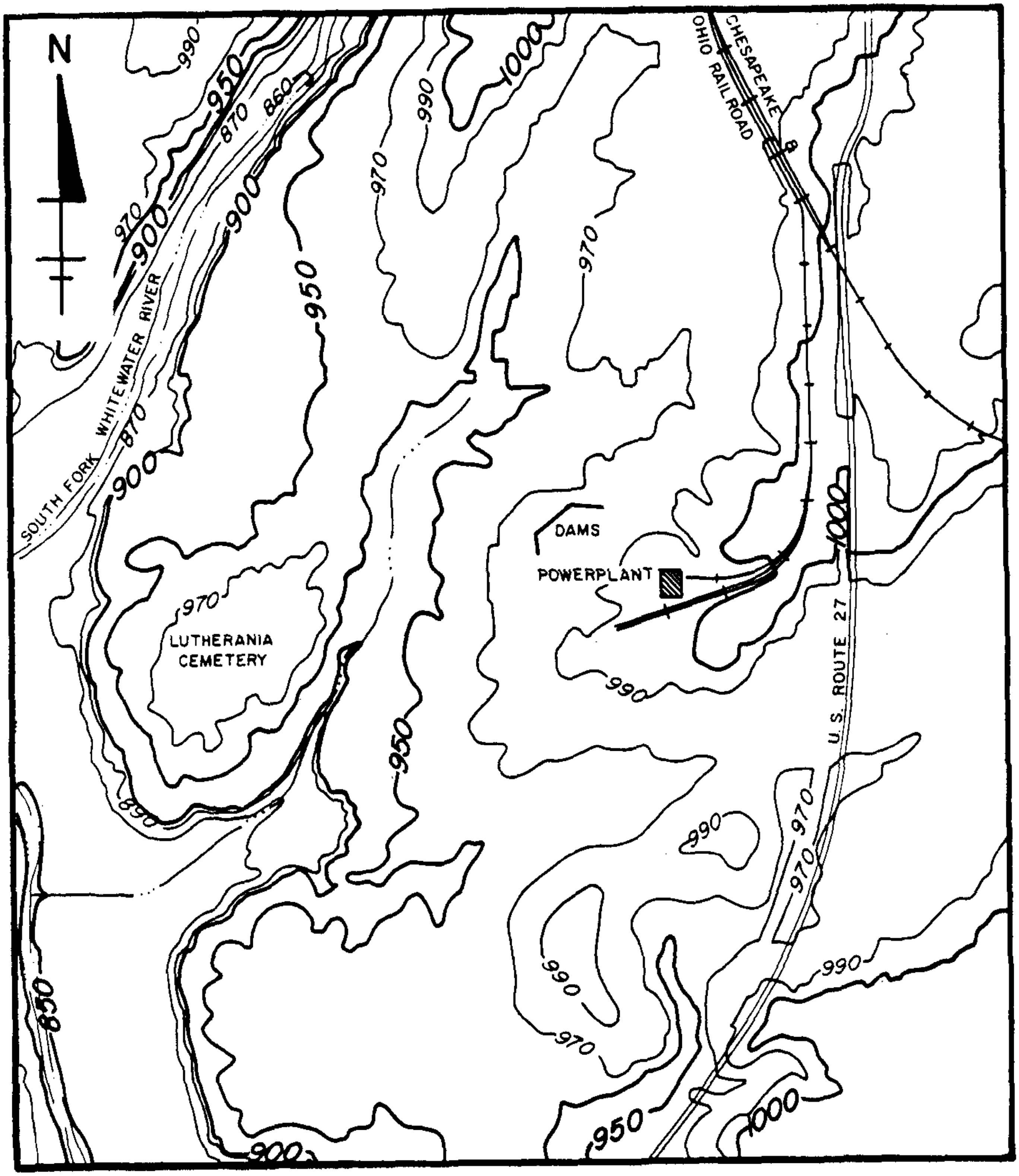
The entire RP&L facility lies well above the probable maximum flood level for the area (Stevenson, 1990). Figure 3-3 shows the 100-year floodplain for the East Fork Whitewater River. Maximum elevations for flood water are 871.4 feet near Test Road and 866.4 feet in the area of the city of Richmond wastewater treatment plant. As the maximum elevations move downstream, they continue to drop (Stevenson, 1990). The RP&L powerhouse is situated at an elevation of approximately 995 feet, well above the designated flood plains. Inspection of a drainage channel west of the site, known locally as Dubner's Ditch, revealed that the channel has a tendency to run full during heavy rain events, but would not be a threat to flood the powerplant.

The U.S. Fish & Wildlife wetlands map, included as Figure 3-4, shows several wetlands in the vicinity of the powerplant. Wetlands on the RP&L property are associated with the ash and sediment ponds and classified PUBFx (Palustrine, Unconsolidated Bottom, Semipermanently Flooded, Excavated) and PUBGx (Palustrine, Unconsolidated Bottom, Intermittently Exposed, Excavated) (USF&WS, 1979). Appendix A gives a detailed explanation of the classification codes for these on-site wetlands. A display of wetlands classification hierarchy is included in Figures 3-5 and 3-6.

3.3 Water Resources

The Whitewater Valley Generating Station is located approximately 3/4 of a mile east of the East Fork Whitewater River. The East Fork Whitewater River originates just north of New Paris,

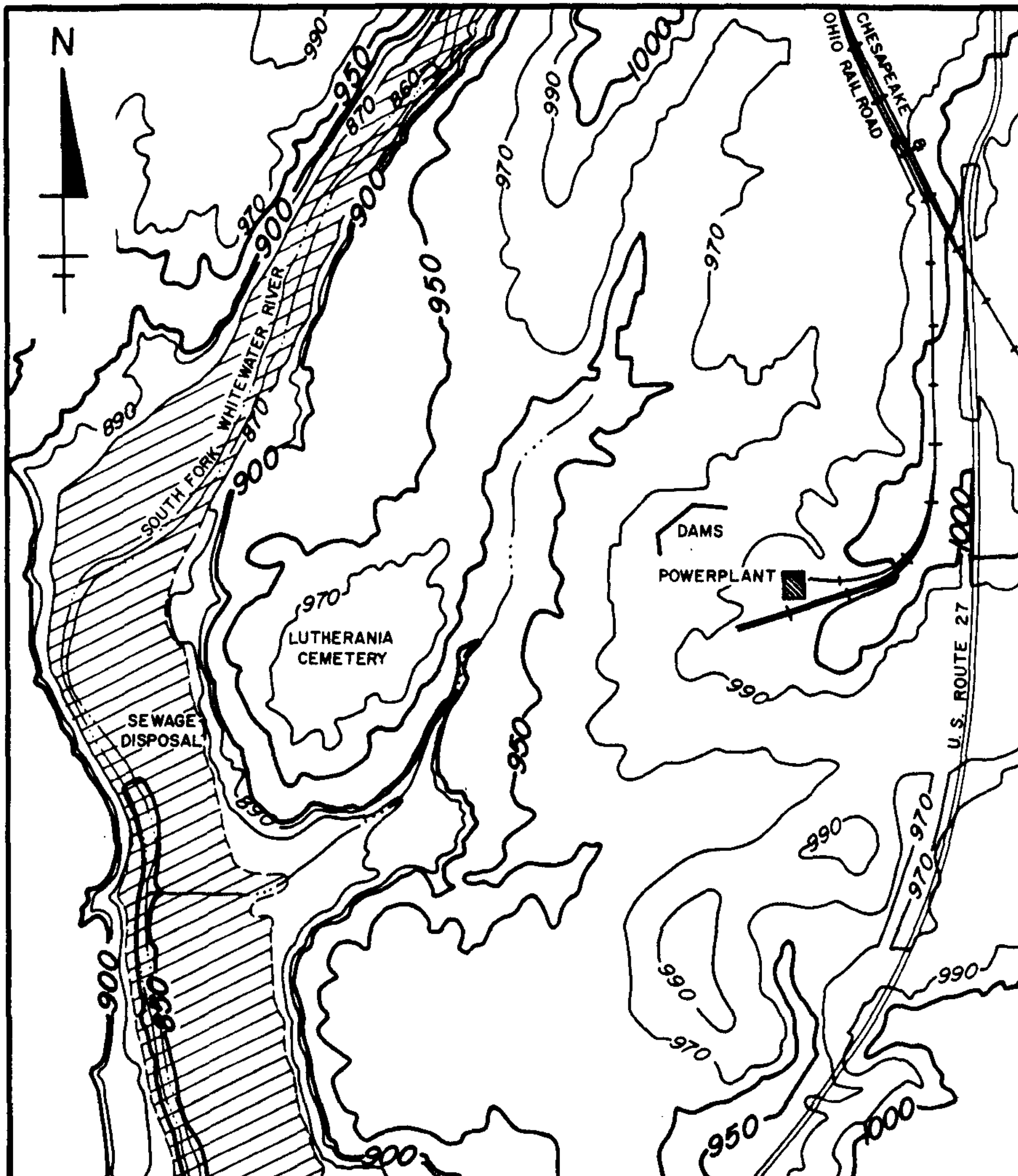
FIGURE 3-2
U.S.G.S. CONTOUR INTERVALS
AREA SURROUNDING WHITEWATER VALLEY GENERATING STATION



REFERENCE:
SELECTED CONTOURS AND FEATURES TAKEN FROM U.S.G.S. 7.5' TOPOGRAPHIC MAP RICHMOND QUADRANGLE, IND., DATED: 1960, PHOTOREVISED: 1981, SCALE: 1"=2000'

SCALE: 1" = 1000'

FIGURE 3-3
FLOOD PLAIN MAP
AREA SURROUNDING WHITEWATER VALLEY GENERATING STATION

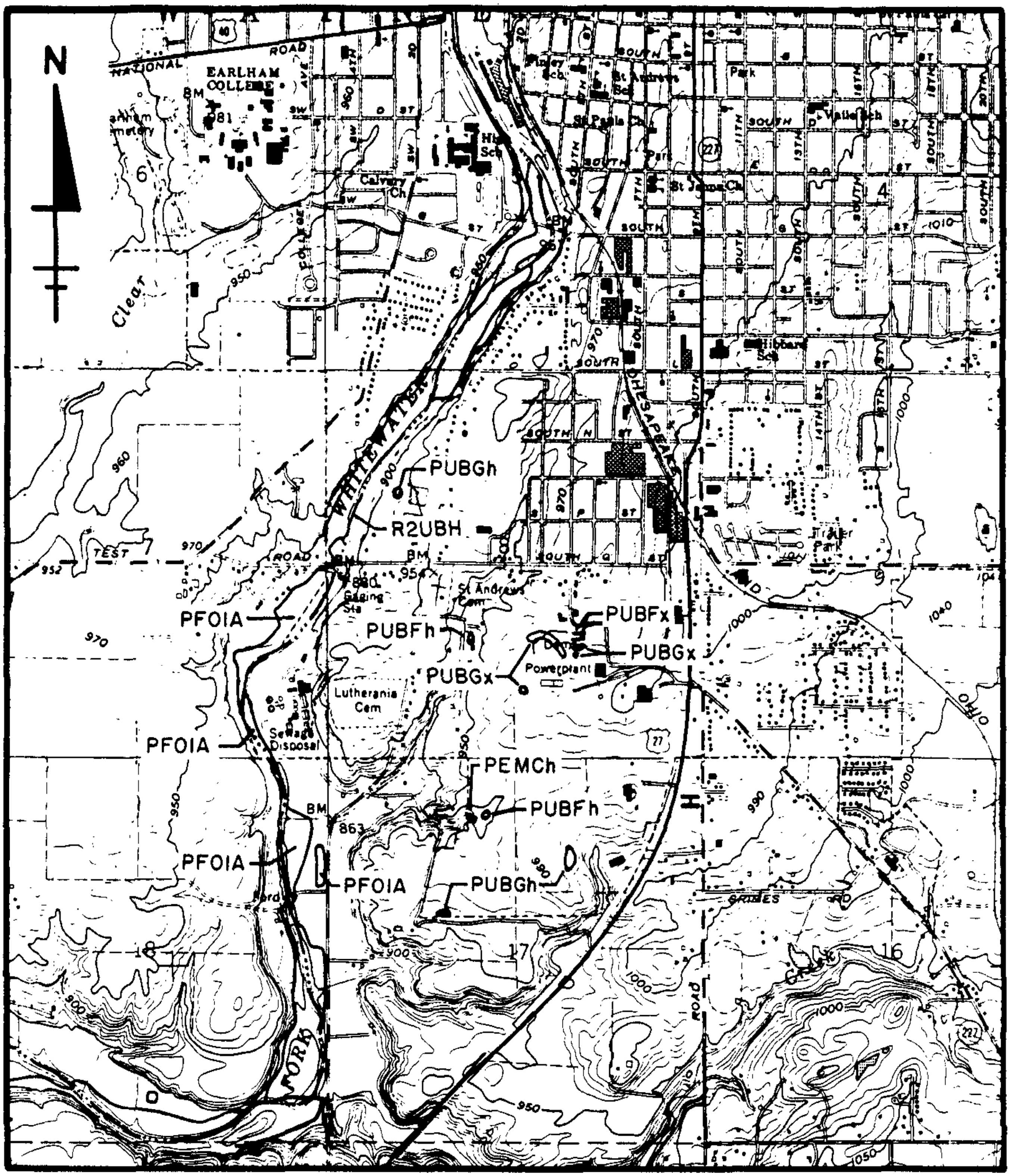


REFERENCE:
SELECTED CONTOURS AND FEATURES TAKEN FROM U.S.G.S. 7.5' TOPOGRAPHIC MAP RICHMOND QUADRANGLE, IND., DATED: 1960, PHOTOREVISED: 1981, SCALE: 1"=2000'

SCALE: 1" = 1000'

LEGEND
APPROXIMATE LIMITS OF 100 YEAR FLOOD

FIGURE 3-4
WETLANDS MAP
WHITEWATER VALLEY AREA



REFERENCE:

BASE MAP FROM THE U.S.G.S. 7.5' TOPOGRAPHIC MAP RICHMOND QUADRANGLE, IND. DATED: 1960, PHOTOREVISED: 1981
WETLANDS INFORMATION PROVIDED BY U.S. FISH AND WILDLIFE SERVICE, NATIONAL WETLANDS INVENTORY.

SCALE: 1" = 2000'

FIGURE 3-5
U.S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE — 1988 NATIONAL WETLANDS INVENTORY
WETLANDS CLASSIFICATION HIERARCHY

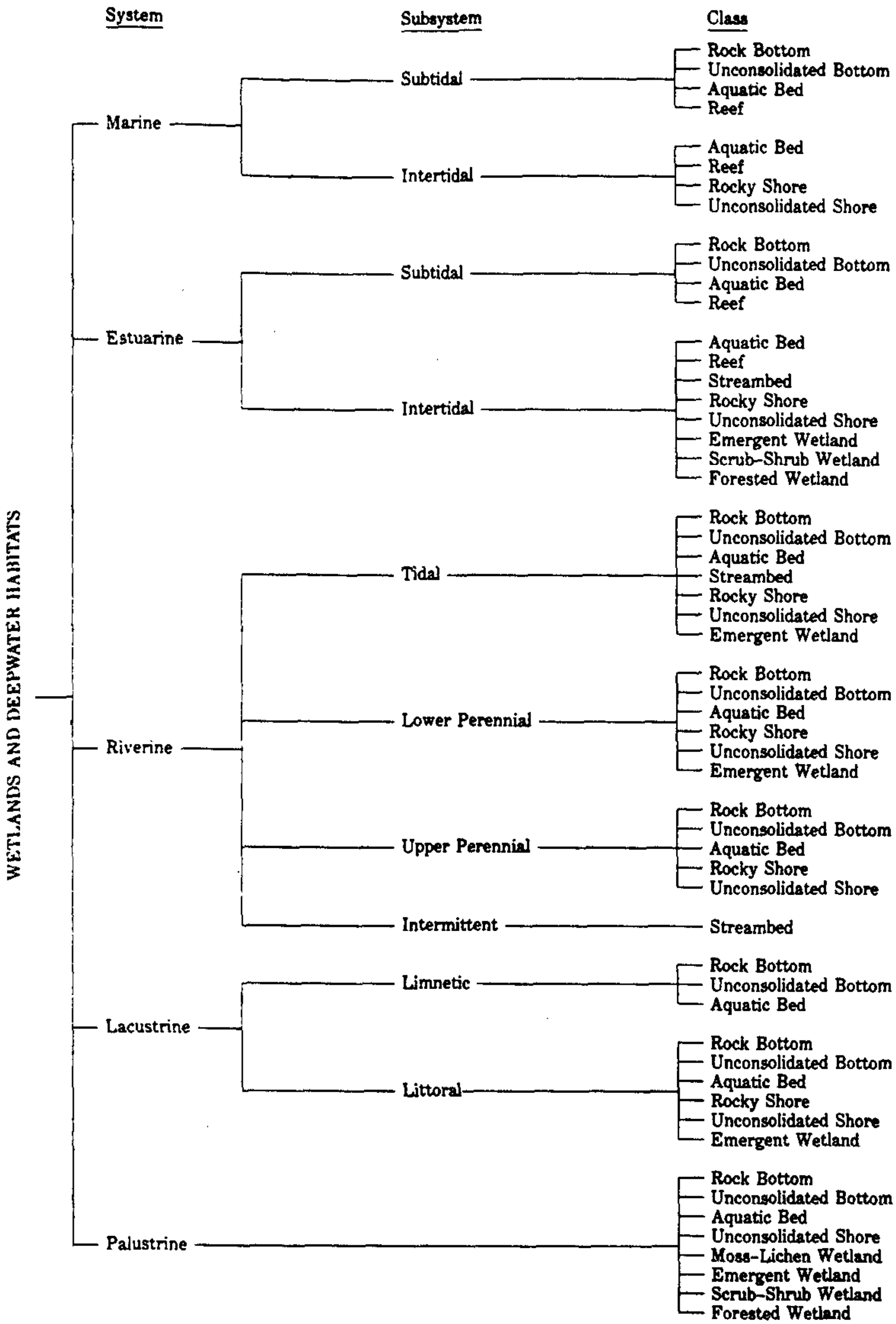
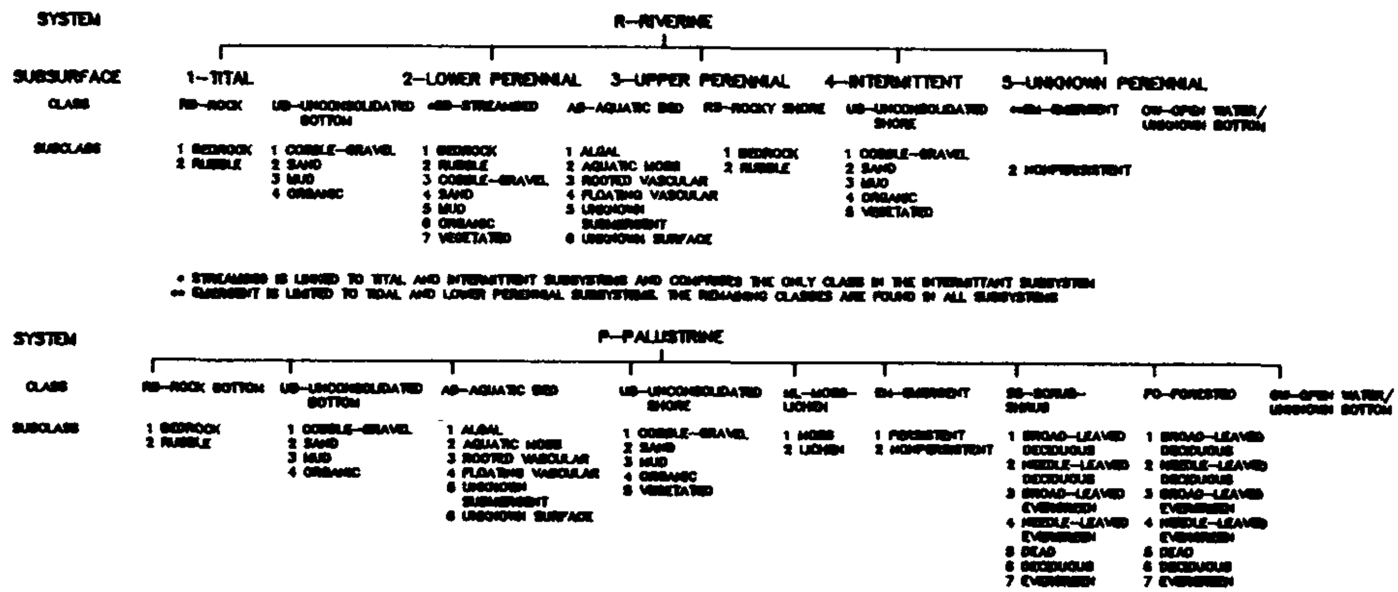


FIGURE 3-6
WETLANDS CLASSIFICATION HIERARCHY
INCLUDING SUBCLASSES, MODIFIERS AND ABBREVIATIONS



MODIFERS

IN ORDER TO MORE ADEQUATELY DESCRIBE WETLAND AND DEEPWATER HABITATS ONE OR MORE OF THE WATER REGIME, WATER CHEMISTRY, SOIL, OR SPECIAL MODIFERS MAY BE APPLIED AT THE CLASS OR LOWER LEVEL IN THE HIERARCHY. THE FORMED MODIFER MAY ALSO BE APPLIED TO THE ECOLOGICAL SYSTEM.

WATER REGIME				WATER CHEMISTRY			SOIL	SPECIAL MODIFERS	
NON-TIDAL		TIDAL		COASTAL HALINITY	INLAND SALINITY	pH MODIFERS FOR ALL FRESH WATER			
A TEMPORARILY FLOODED B SATURATED C SEASONALLY FLOODED D SEASONALLY FLOODED/ WELL DRAINED E SEASONALLY FLOODED/ SATURATED F SEMIPERMANENTLY FLOODED G INTERMITTENTLY EXPOSED	H PERMANENTLY FLOODED J INTERMITTENTLY FLOODED K ARTIFICIALLY FLOODED W INTERMITTENTLY FLOODED/TEMPORARY Y SATURATED SEMIPERMANENT/ SEASONAL Z INTERMITTENTLY EXPOSED/PERMANENT U UNKNOWN	K ARTIFICALLY FLOODED L SUBTIDAL M IRREGULERLY EXPOSED N REGULERLY FLOODED P IRREGULERLY FLOODED	* S TEMPORARY—TIDAL * R SEASONAL—TIDAL * T SEMIPERMANENT—TIDAL * V PERMANENT—TIDAL U UNKNOWN	1 HYPERHALINE 2 EUHALINE 3 MIXOHALINE (BRACKISH) 4 POLYHALINE 5 MESOHALINE 6 OLIGOHALINE 0 FRESH	7 HYPERSALINE 8 EUSALINE 9 MIXOSALINE 0 FRESH	a ACID t CIRCUMNEUTRAL i ALKALINE	g ORGANIC n MINERAL	b BEAVER d PARTIALLY DRAINED/ DITCHED f FARMED	h DIKED/IMPOUNDED r ARTIFICIAL SUBSTRATE s SPOIL x EXCAVATED

* THESE WATER REGIMES ARE ONLY USED IN TIDALTY INFLUENCED FRESHWATER SYSTEMS.

Ohio, and flows west until it reaches Richmond, Indiana, where it turns south and passes near the RP&L facility. The river continues south and empties into Brookville Lake, which is formed by a dam just above Brookville, Indiana. Water leaving the lake continues south and joins the Whitewater River, which subsequently empties into the Ohio River at the intersection of the Indiana, Ohio and Kentucky state lines.

Water used at the plant is supplied from the East Fork Whitewater River and IAW. River water is pumped to the facility for use in cooling, as a seal for the boilers or to create a suction in the ash collection system. Cooling water is recirculated and stored on-site in a three-million-gallon holding tank. A treatment plant at the RP&L facility is used to clarify and chemically adjust, e.g., pH, the river water. Water from IAW is used as the drinking water source, during dustless unloading from the ash storage silos and for bearing cooling. IAW derives its water from the Middle Fork Reservoir and several wells. There are no wells operating on the RP&L property.

Water used to seal the boiler gradually overflows and moves to the on-site sediment ponds seen on the facility plan view (Figure 2-4). The rain gutters, floor drains, surface runoff, boiler blowdown and Unit 1 cooling tower blowdown also enter the sediment ponds. There are four ponds connected in series by overflow pipes and each pond has a surface area of approximately 10,000 square feet. The ponds are 15 feet deep and have a total capacity of approximately 4.5 million gallons. The volume of water that the ponds can hold varies with the amount of settled material in the ponds. Currently, approximately 1.7 million gallons of storage capacity exists. Approximately 150,000 gallons of water enter the sedimentation ponds each day and during cooling tower blowdown events the flowrate rises to about 320,000 gallons per day. The ponds have a current estimated retention time of five days.

Water used to create suction in the wet fly ash collection system and for sluicing bottom ash contains small amounts of suspended ash and is discharged to a series of on-site ash ponds for clarification. There are four ponds connected by french drains and overflow pipes. The surface area of the ponds is difficult to calculate due to their changing physical layout and irregular shaping (see Figure 2-4), but the ponds have a total estimated surface area of 170,000 square feet and vary in depth from six inches to five feet. Total estimated storage capacity of the ponds is 1.6 million gallons. The current wet ash transport system requires approximately 540,000 gallons of water per day and this volume eventually enters the ash pond network. Less than 5% of the ash moved by the system (less than six tons per day) is unintentionally carried with the water flow into the ash ponds. The ash ponds have an estimated retention time of three days. If needed, the sedimentation ponds can be used to create additional ash pond volume.

Ash and sediment pond overflows merge and enter a city storm sewer on the RP&L property. Effluent characteristics for this flow are available in the NPDES permit application included in Appendix C of this document. The sewer joins a 72" tile pipe which services much of the Richmond storm sewer system and this pipe discharges into Dubner's Ditch just below South Q street. Dubner's Ditch runs southwest between the powerplant and the river joining the East Fork Whitewater downstream of the city of Richmond wastewater treatment plant. The quantity of water carried by Dubner's Ditch on a regular basis has not been measured; however, it flows continuously and the Richmond Sanitary Department reference estimates RP&L's contribution as no more than a fifth of the total flow.

Sanitary wastewater from the facility is treated at the city wastewater treatment plant which is located about 1/2 mile west of RP&L on the east bank of the East Fork Whitewater River. The plant is a class four facility (serving a population of 30,000 - 40,000) utilizing an activated sludge treatment process (Kelly, 1990). Plant effluent enters the East Fork Whitewater River.

Water quality testing on the East Fork Whitewater River is performed by IDEM on a quarterly basis at a United States Geological Survey (USGS) gaging station located in Abington, Indiana. This sample point is located about six miles south of the city of Richmond on the west bank of the river. Sample data for the year 1989 is included in Table 3-2. Separate sampling is performed by IDEM for metals in the river and this data is included in Table 3-3 (Gibson, 1990).

3.4 Ecological Resources

The region surrounding Whitewater Valley is mostly urban and woodland areas, with some farmland and remnants of strip mining. The wooded lands in the region are classified as temperate deciduous forest and contain a large number of plants which produce pulpy fruits and nuts, such as acorns and beechnuts. Oak, hickory, maple, beech and pine are the dominate tree species in the area.

TABLE 3-2

STREAM TESTING PARAMETERS*
EAST FORK WHITEWATER RIVER

Parameter	Units	Mar	Jun	Sep	Dec
Ammonia/Nitrogen	mg/l	0.1	0.1	0.1	0.1
5 Day BOD	mg/l	2.6	1.0	<1.0	1.3
Dissolved Oxygen	mg/l	13.6	9.4	10.6	14.2
Nitrate/Nitrite/Nitrogen	mg/l	5.4	2.7	3.9	3.8
Phosphorous	mg/l	0.2	0.1	0.2	0.1
Total Suspended Solids	mg/l	1.0	18.0	4.0	2.0
Temperature	°C	3.0	23.5	16.2	0.4
pH	Standard	8.1	8.2	8.2	8.0
E. coli	E. coli/100 ml	60.0	610.0	600.0	700.0

* Results are from Indiana Department of Environmental Managements Office of Water Quality Surveillance and Standards quarterly data for the year 1989.

TABLE 3-3

STREAM TESTING PARAMETERS*
EAST FORK WHITEWATER RIVER

Parameter	**Units**	**Upstream**	**Downstream**	**Blank**
Arsenic	ug/l	2.1	0.8	<0.2
Cadmium	ug/l	<2	<2	<2
XChrome	ug/l	<10	<10	-
TChrome	ug/l	<10	<10	<10
Copper	ug/l	6	5	<4
Cyanide	mg/l	<0.005	0.023	<0.005
Iron	ug/l	40	90	<20
Lead	ug/l	<6	<6	<6
Manganese	ug/l	10	10	-
Mercury	ug/l	<0.1	<0.1	<0.1
Nickel	ug/l	7	<4	<4
Sulfates	ug/l	30	10	<10
Zinc	ug/l	98	64	-

* Results are from Indiana Department of Environmental Managements Office of Water Quality Surveillance and Standards data from November 19, 1989. The upstream data was taken at Test Road and the downstream data was taken at a ford just downstream from where Dubner's Ditch empties into the river.

IDEM's Division of Nature Preserves indicates that several species of wildlife are listed as endangered or threatened, federally or on a state level, for the Richmond quadrangle. The Indiana or social bat is considered endangered on both a state and federal level. Kirtland's snake is considered a threatened species by the state and is under consideration federally for endangered status. The common barn own and the king rail are bird species listed as endangered by the state of Indiana. No plant life is considered endangered for the quadrangle but the softleaf arrow-wood and barren strawberry are designated as threatened by the state (Martin, 1990).

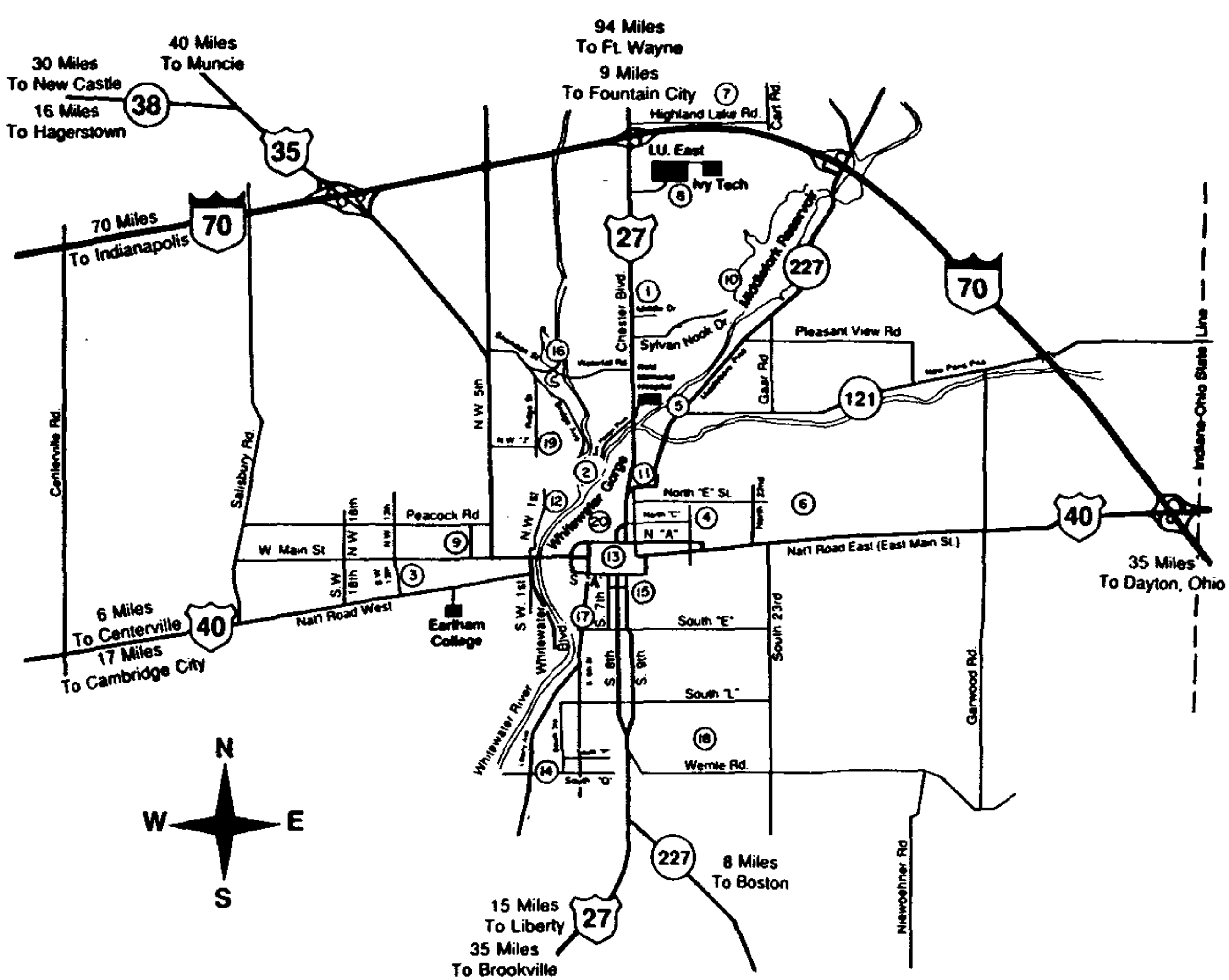
The Middlefork Reservoir is located approximately four miles north of Whitewater Valley and has a surface area of 117 acres. The reservoir reaches depths of 60 feet and is home to several species of fish. Largemouth bass, crappie, northern pike, channel cat and bluegill are the most abundant species. The East fork Whitewater River also contains several species of fish with bluegill, crappie and smallmouth bass dominating the population (Miller, 1990).

3.5 Socioeconomic Resources

The Whitewater Valley Generating Station is located just inside the southern limit of the city of Richmond in Wayne County. Richmond has a population of approximately 40,000, while a total of approximately 74,550 people reside in the county (Beymer, 1990). In the area, there is a pool of skilled and unskilled labor which can provide the necessary local talents for fabrication and other activities related to the demonstration project. In January 1990, the unemployment rate for Richmond was 7.7%. This figure is up slightly from 1989, but significantly lower than the average for the decade (Beymer, 1990). There are several neighborhood parks and recreational areas in Richmond, Indiana, which are shown in Figure 3-7. Several historical and archeological sites have been listed in the city of Richmond (HLI, 1990, Cochran 1990). A list of the historical sites is included as Table 3-4. No archaeological sites have been previously identified within the boundaries of the RP&L property; however, 257 archaeological sites have been recorded in Wayne County and seven of these sites are within one mile of the powerplant (Zoll, 1990).

Route 27 runs north and south along the east side of the RP&L property. Route 40 crosses Route 27 about two miles north of the plant, and Interstate 70 crosses over Route 27

FIGURE 3-7
RICHMOND PARKS



Richmond Parks Directory

1. BERRY FIELD PARK
2. BICENTENNIAL PARK
3. CLEAR CREEK PARK
4. EAST SIDE LIONS PARK
5. FREEMAN PARK
6. GLEN MILLER PARK AND GOLF COURSE
7. HIGHLAND LAKE GOLF COURSE
8. I.U. EAST/IVY TECH COMMUNITY PARK
9. MARY SCOTT PARK
10. MIDDLEFORK RESERVOIR
11. NORTH 10TH STREET PARK
12. RIVERSIDE PARK
13. PROMENADE
14. SENIOR CITIZEN CENTER
15. SOUTH 10TH STREET PARK
16. SPRINGWOOD LAKE PARK
17. SWICKER PARK
18. WERNLE PARK
19. WEST SIDE LIONS PARK
20. WHITEWATER GORGE

TABLE 3-4

HISTORIC SITES OF RICHMOND, INDIANA

Landmark	Date Landmark Put on National Register
Bethel A.M.E. Church	09-05-75
Earlham College Observatory	10-21-75
East Main Street - Glen Miller Park Historic District	03-27-86
Abran Gaar House and Farm	02-20-75
Henry and Alice Gennett House	08-11-83
Hicksite Friends Meetinghouse	10-14-75
Leland Hotel	02-28-85
Murray Theatre	03-25-82
Old Richmond Historic District	06-28-74
Richmond Gas Company Building	06-25-81
Richmond Railroad Station Historic District	10-08-87
Andrew F. Scott House	10-10-75
Samuel G. Smith Farm	01-14-83
Starr Historic District	06-28-74
Starr Piano Company Warehouse and Administration Building	06-18-81
Wayne County Courthouse	12-08-78

Notes: There are 12 other structures in Wayne Township that will be put on the Register in the near future; and another 46 suggested for consideration. There are two more Historic Districts being considered for inclusion on the Register.

five miles north of the plant. There is an interchange with Interstate 70 at this junction. The Norfolk, Chesapeake & Ohio, and Penn Central railroads service Richmond, and the power plant is connected by a privately-owned siding, which could be used following routine maintenance.

Project management and engineering will be primarily supplied by ICF Kaiser Engineers, while additional engineering support will be provided by Tampella, the Finland-based company which developed LIFAC. EPRI is also a project team member and will help familiarize U.S. industry with the technology and the results of the demonstration. Several important members of the U.S. business community are participating in the project because they believe that this demonstration project may provide an important part in this nation's search for a more economical clean coal technology:

- Peabody Coal Company - The nation's largest coal producer with 81 million tons of output in 1985 and production from nearly every major U.S. coal field.

- Black Beauty Coal Company - One of the leading coal companies in Indiana.

- Lafarge - One of the nation's largest building products, cement and lime producers (verbal agreement; awaiting written confirmation).

- Richmond Power & Light (RP&L) - The host for this demonstration, is one of the nation's most respected municipal electric utilities.

3.6 Energy and Materials Resources

The material resources for this project are coal, limestone and water.. The coal comes from mines in western Indiana, including coal purchased on contract from the Black Beauty and Peabody Coal Companies. Coal characteristics are shown in Table 2-1. Limestone will be supplied by local vendors. Table 3-5 shows a general limestone characterization for limestone in the Richmond area. Water is supplied from the East Fork Whitewater River, and no limitations are expected during the demonstration period.

TABLE 3-5

TYPICAL INDIANA LIMESTONE
CHARACTERIZATION
(DRY BASIS)

Substance	% weight
Calcium Carbonate ($CaCO_3$)	97.35
Magnesium Carbonate ($MgCO_3$)	1.20
Silica	0.74
Alumina	0.56
Iron Oxide	0.15
Particle Size	200 mesh or finer
Pulverized Density	25-58 lb/ft^3

Source: Indiana Limestone Institute

SECTION 4.0

CONSEQUENCES OF THE PROJECT

4.0 CONSEQUENCES OF THE PROJECT

This section discusses the potential consequences of installation and operation of the LIFAC technology at the Whitewater Valley Generating Station. The consequences will be considered as they apply to the environment described in Section 3.0.

4.1 Impacts of Proposed Project

Information and data presented in this subsection demonstrate that the LIFAC project at Richmond Power & Lights Whitewater Valley Unit 2 Generating Station will benefit the environment as compared to present operation of the unit in its baseline configuration.

4.1.1 Atmospheric Impacts

The LIFAC demonstration period is not of sufficient duration to affect air quality conditions in east central Indiana; however, SO_2 emissions during the LIFAC demonstration will decrease from that currently occurring during baseline operation. LIFAC will decrease SO_2 emissions from the Whitewater Valley powerplant by 75-85%.

A rise in the concentration of CO_2 is expected due to the calcination of $CaCO_3$; however, this is true of all limestone adsorption processes, and the increase of CO_2 is minimal when compared to the high volume of CO_2 produced by burning coal. The limestone consumed during the LIFAC process will account for approximately 3% of the CO_2 in the plant's flue gas. This slight CO_2 increase is acceptable considering the 75-85% reduction of SO_2 that will occur concurrently. Particulate emissions are expected to remain constant. At this time, the proposed LIFAC demonstration does not include plans for NO_x removal. However, LIFAC North America has begun some preliminary investigation of the possible coupling of the LIFAC technology with NO_x controls. At a later date, a revised Whitewater Valley demonstration plan, including NO_x reduction technology, may be presented in a separate proposal.

The following table summarizes the plant emissions and changes expected after the LIFAC technology is applied. The figures represent full load design conditions with a 2.4% sulfur coal (chosen for calculations but cannot be established until after commissioning by DOE) and feed rate constant at 30 tons/hr. The coal is estimated at 70.5% carbon (Table 2-1).

Emissions	Baseline	LIFAC Technology Applied
SO_2	4.1 lb/MMBtu	1.0 lb/MMBtu
NO_x	0.65 lb/MMBtu	0.65 lb/MMBtu
CO_2	229 lb/MMBtu	236 lb/MMBtu
particulate	0.12 lb/MMBtu	0.12 lb/MMBtu

Currently, the powerplant emits about 9,178 tons per year of SO_2 based on an average emission rate of 4.1 pounds of SO_2 per million Btu of input and an annual utilization of 75%. If the LIFAC system were to be operated at a 75% annual utilization, LIFAC would remove approximately 6,884 tons of SO_2 per year. For the envisioned 2800 hour demonstration, about 2,200 tons of SO_2 will be removed.

The SO_2 emissions will vary during the initial testing and demonstration when planned modifications to the system will be implemented for the purpose of studying their effects on the efficiency of the technology. Variations will include: sulfur content of feed coal, quantity of limestone injected, location of limestone injection, and direction of humidification nozzles.

Particulate emissions for the state of Indiana are set by the Indiana Air Pollution Control Board (APCB) and enforced by IDEM. Currently, the limit for RP&L is under review but will likely be set in the range of 0.15-0.20 lb/MMBtu. Recent stack tests at the powerplant concluded that RP&L's current particulate limit is below this range. During LIFAC, the limestone injection step will increase particulate loading to the system but several factors will act to counterbalance its effect and keep RP&L within the APCB limit. These factors are:

- The coal to be used during the LIFAC demonstration will have a lower ash content and higher heating value than that used during recent stack tests.

- LIFAC's activation chamber will collect about 25% of dry waste prior to the ESP.

- The humidification step lowers flue gas temperature which increases gas conductivity and lower the gas volume and flow rate. This improves ESP performance.

- The ESP insulation could be improved to further enhance its efficiency.

The ability of LIFAC to operate at or below particulate emission limits at RP&L is further supported through past experience. Tests at the Inkoo powerplant in Finland and the LIMB demonstrations at Whitewater Valley and Edgewater, revealed that humidification and the subsequent drop in flue gas temperature actually reduced particulate emissions to levels at or below that encountered without the limestone injection technologies activated. Detailed emission analyses will be conducted during the Design Phase of the demonstration project.

Air emissions during the retrofitting procedure at Whitewater Valley Unit 2 (installation activities described in Section 2.1.3.2 of this report), will be limited to construction vehicle and fugitive emissions. Emissions from vehicles involved in the construction of delivery of equipment will be minimal. Some of the construction activity will be done inside the powerhouse and therefore controlled by the structure itself. Compared to ongoing activities of the site, the transportation and construction equipment required for modifying of the present complex to accommodate the LIFAC components will not cause a significant increase in emissions. Therefore, the planned construction activities are expected to have negligible impact upon air quality.

4.1.2 Land Impacts

Construction activities for the LIFAC demonstration will be confined to the RP&L property. The only new construction that will take place outside the powerplant building is the erection of the activation chamber (with slag collection/storage equipment) and new limestone silo. The activation chamber will take up approximately 550 square feet of unused space next to the new stack on the east side of the building and the limestone silo will require approximately 200 square feet on the west side of the building, next to the existing silo. All precautions will be taken to control erosion during the construction. No floodplain, wetland, pond or drainage system will be affected by this work.

The LIFAC technology will increase the volume of fly ash produced by the plant. During normal operation, assuming coal usage of 30 tons per hour and an 11% ash content for the coal, the system produces 0.66 tons per hour of bottom ash and 2.64 tons per hour of fly ash. When the LIFAC technology is applied to the process, an additional 5.5 tons per hour of LIFAC waste will be produced, of which 25 percent will be collected in the reaction chamber hoppers, and the remaining 75 percent will be removed by the ESPs.

All wastes may be sold or hauled to a landfill. Volumes of solid waste to be sold or disposed off-site will increase from 3.5 cubic yards per hour to 9.3 cubic yards per hour. This increase is based on coal with 11% ash. If all the waste were to go to the smallest facility under consideration, the Richmond Municipal Landfill, it would account for 0.6% of the landfills expected lifetime fill volume and the landfills useful life would be reduced by approximately 42 days. See Section 2.1.3.3., Project Source Terms, for more details.

4.1.3 Water Quality Impacts

The application of the dry ash transport system will be the most significant contribution to a change in water quality attributable to LIFAC. The wet transport system currently requires 540,000 gallons of water per day to move ash from the ESP hoppers, economizer and furnace bottom. With LIFAC in operation, only the bottom ash will be transported using the wet transport system. Moving the bottom ash will require only 54,000 gallons per day. The LIFAC humidification system will require approximately 93,000 gallons of water per day but this volume will be consumed in a chemical reaction or escape in the flue gas.

The sediment ponds will continue to collect boiler seal overflow, surface runoff and floor drainage totalling about 150,000 gallon per day (during Unit 1 boiler blow down events, this volume rises to approximately 320,000 gallons per day).

Therefore, LIFAC will cause an approximate 70% decrease in water discharging to Dubner's Ditch and a 90% decrease in the ash pond contribution to this flow. These decreases will result in a decreased loading of suspended and dissolved solids entering the onsite ponds, the Richmond storm sewer system and Dubner's Ditch.

The wet ash system will be retained as a back-up to the new dry ash system during baseline operation only. The wet system will not be used in conjunction with the LIFAC technology. If problems occur with the dry handling system during the demonstration, operations will cease until it can be resolved.

4.1.4 Ecological Impacts

All construction activities will take place within the plant boundaries. Only the construction of the activation chamber and new limestone storage silo will be outdoors. Construction activities will contribute some noise and fugitive dust emissions to the environment. The limited scope and short duration of construction activity combine to have a negligible impact on the ecology at the site.

The LIFAC demonstration project is not expected to impact any of the State or Federally listed endangered or threatened species of wildlife or plants.

4.1.5 Socioeconomic Impacts

Labor requirements for the construction of the reaction chamber and reinstitution of the presently inactive limestone injection and flue gas humidification is expected to be minimal. The local work force will be utilized to the highest extent possible. The actual demonstration will be conducted using professional personnel from outside the area; whose presence will slightly effect lodging, dining and entertainment establishments in Richmond. The purchase of coal is not expected to change significantly but local limestone vendors will experience increased demand for their product during the demonstration period. The LIFAC project is expected to have an overall positive effect on the economy of the area.

The construction activities at the site will take place in areas previously disturbed during the construction of the powerplant building. The finding of unknown archaeological resources is not expected but if encountered, work will be halted and the Division of Historic Preservation and Archeology will be contacted. The project will resume after the Division's evaluation of the site (Zoll, 1990).

Truck traffic to the plant will increase due to larger quantities of ash needing disposal and limestone deliveries. This increase will not have a noticeable impact on road maintenance or traffic patterns. Care will be taken by all trunks as they travel on U.S. Route 27 through Richmond, but outside the city limits the highway is open and in good repair. Interstate 70 is a major east-west truck route and will be unaffected by the increase.

The reaction chamber and slag bin will be located on the east side of the powerplant building and will therefore be visible from Route 27 and approximate areas just east of the RP&L property. The reactor will rise 148 feet to its highest point which will be slightly higher than the present roof; however, the plants stack is 325 feet high which diminishes the reaction chamber's relative impact. The slag bin is not expected to have an aesthetic effect on the building.

4.1.6 Energy and Materials Impacts

The volume of fuel used is not expected to change during the LIFAC demonstration project. Different varieties of coal will be tested during the demonstration to find a reference coal, but the volume consumed for operation will remain around 30 tons per hour. LIFAC will reduce SO_2 emissions and thus provide a system able to burn high sulfur midwestern bituminous coals, while meeting regulatory requirements. This may help avoid dislocation of the mining industry due to increased demands for low sulfur coal.

The estimated electrical power consumption attributed to the LIFAC demonstration is about 500 Kw-hr/hr. Although this rate is not negligible, it represents only 0.8 percent of the total net generating capacity of Unit 2, 0.5 percent of the Whitewater Valley Station capacity, and 0.1 percent of RP&L's system capacity. To make up for this loss, more power will need to be supplied by another source in the RP&L power grid.

The entire LIFAC project will require about 16,520 tons of limestone. Capacity exists to deliver 17 million tons per year of limestone to the U.S. market. Therefore, the project will require only 0.1 percent of the U.S. limestone supply. Limestone availability is not a problem because many quarries exist in Indiana and Ohio.

4.1.7 Impact Summary

The LIFAC demonstration will impact the environment differently than the operation of Unit 2 in its baseline configuration. Fuel usage by Unit 2 is not expected to change. Consumption of limestone will impact solid waste production. Emissions of SO_2 will decrease significantly during the demonstration, resulting in lower ambient concentrations near the generating station. Particulate emissions are not expected to change and will be controlled to meet the state regulations. Effluent discharges from the ash pond will decrease with the application of the dry ash handling system. The wet system will be operated during the demonstration for bottom ash handling only.

The impact on the local economy will be positive but not of a significant magnitude. Purchasing construction supplies, utilizing local labor, lodging and feeding of visiting personnel, and limestone purchase will all contribute positively to the local economy without overburdening it, Impact on the local economy will be slight and of limited duration.

Solid waste requiring disposal will increase during the demonstration period. The waste will be landfilled or sold for beneficial use.

4.2 Impact of Alternatives

Impacts on the environment due to implementation of an alternative program are discussed in this subsection.

4.2.1 No Action

Under this alternative, the LIFAC technology would not be installed at Whitewater Valley Station. As a result, environmental conditions at the site would be no different than under existing conditions. In particular, SO_2 emissions would remain unchanged from current operating conditions. The benefits gained from reducing these emissions by using the LIFAC process would not be realized.

4.2.2 Alternative Technologies

Installation of an alternative emissions control scheme at the Whitewater Valley Station would not provide information to DOE or LIFAC-North America regarding the effectiveness of LIFAC as a retrofit technology for typical coal-fired boilers in the United States. LIFAC is expected to significantly reduce the emission of SO_2 when compared to in-furnace or in-duct technologies. The alternate technologies discussed in Section 2.2.2 have either been tested or are in commercial operation for similar applications. Installation of one of these would not advance the investigation or confirmation of LIFAC's unique advantages. Therefore, installation of an alternate technology is not a practical option.

4.2.3 Alternative Sites

Alternative sites are generally investigated to mitigate any adverse consequences arising out of the long-term or permanent operation of a proposed project. Since no detailed investigation of alternative sites was conducted, no environmental consequences associated with alternate sites can be discussed at this time.

SECTION 5.0

REGULATORY COMPLIANCE

5.0 REGULATORY COMPLIANCE

This section describes current permit requirements and regulations governing plant operation, while outlining the anticipated permit modifications and the process by which they will be obtained.

5.1 Regulations and Permit Requirements

Demonstration of the LIFAC technology will be on a retrofit basis for the Whitewater Valley Unit 2 boiler; therefore, RP&L will be required to meet the emission and discharge limits currently imposed by regulatory agencies in controlling their operations.

The IDEM Air Pollution Control Board (APCB) currently imposes limits on SO_2 and opacity at Whitewater Valley. SO_2 emissions are limited to 6.0 lb/MMBtu. Opacity measurements are limited to 40% average for six minutes or 60% opacity for more than a cumulative total of 15 minutes in a six hour period. Exemptions exist on opacity limits during sootblowing and start-up. The utility is required to submit quarterly operating records to document compliance with these limits and to document the date, length of occurrence and reason for any deviations from emissions limits. On October 1, 1982, RP&L submitted a permit application to renew its boiler permit. IDEM did not issue a draft permit until 1984, which included a requirement to increase the stack height in order to comply with new regulations. RP&L decided it would not be able to meet the new stack height requirements immediately and the permit application was withdrawn. Upon completion of the new stack in the fall of 1989, RP&L submitted a revised boiler permit application. The draft is now in the process of IDEM approval and is expected to be issued prior to start-up of the LIFAC demonstration. During the 1984 to 1989 period, RP&L was required to comply with emissions limits and reporting requirements in the 1984 draft boiler permit.

During the LIFAC demonstration, the volume of water required for ash transport will be decreased by virtue of the conversion to a dry fly ash handling system. However, the use of water for the sluicing of bottom ash will be maintained throughout LIFAC. Discharge from the sediment and ash ponds is not currently regulated by IDEM under the NPDES program; however, RP&L has applied for an NPDES permit and approval is expected prior to start-up of the demonstration.

5.2 Anticipated Permit Modifications

5.2.1 Air Permit Modifications

The Whitewater Valley Station is located in the East Central Indiana Intrastate Air Quality Control Region. The area surrounding RP&L is a primary attainment area for the U. S. EPA criteria pollutants: total suspended particulates, ozone, carbon monoxide and NO_x. The area is a primary non-attainment area for SO_2. Previous experience during the LIMB demonstration project indicated that IDEM would require all current emission limits to be met; no permit modifications would be required for the demonstration period, and no variances would be allowed for non-compliance as a result of the demonstration.

The current particulate emission limits for Whitewater Valley were established by the APCB on September 26, 1980. The limits are 0.04 lbs/MMBtu for Unit 1 and 0.007 lbs/MMBtu for Unit 2. The addition of the common stack in 1989 influenced plant emissions and opened these limits to review by the state. RP&L and IDEM are currently negotiating a combined (Units 1&2) emission limit for the power plant. The limit will likely to set in the 0.15-0.02 lbs/MMBtu range. Whitewater Valley currently operates below this range and is expected to continue to do so when LIFAC is in operation.

5.2.2 Solid Waste/Water Permit Modifications

As described in Section 4.1.3, the net discharge of water at Whitewater Valley will decrease by about 50% when the LIFAC technology is in operation. However, the quality of this discharge water will remain the same or show improvement. For these reasons, no modifications to the pending NPDES permit are anticipated.

Management of the fly ash and LIFAC waste generated during this demonstration program will be conducted in accordance with all applicable federal, state and local regulatory requirements. The IDEM Division of Solid Wastes has regulatory authority for the dry disposal of wastes. Disposal of the LIFAC waste in an off-site landfill will require approval prior to disposal at the landfill. The application for approval must identify the waste generator and disposal facility operator and must provide a detailed characterization of the waste.

5.2.3 Other Required Permits

All of the LIFAC equipment will be installed within the boundaries of the plant; thus, zoning and land use issues are not applicable. Construction permits for installation of the equipment will be applied for from state and local authorities. In general, it is anticipated that demonstration of the LIFAC technology will be conducted in an environmentally sound manner in complete compliance with all applicable environmental regulations without the imposition of extraordinary control measures.

SECTION 6.0

REFERENCES

REFERENCES

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SECTION 7.0

PREPARERS AND

PROFESSIONAL QUALIFICATIONS

THOMAS R. McKINNEY, P.E.

EDUCATION

1984 M.S., Nuclear Engineering, University of Washington

1973 B.S., Chemical Engineering, Oregon State University

PROFESSIONAL REGISTRATIONS

Registered Professional Engineer: Washington, Illinois

EXPERIENCE SUMMARY

Mr. McKinney serves as vice president and manager of the Pittsburgh and Chicago offices for ICF Kaiser Engineers' Environmental Systems Group. As vice president, Mr. McKinney is responsible for technical quality and project management in the areas of remedial investigations, feasibility studies, remedial design and construction management and regulatory compliance review as well as environmental audits and assessments. Prior to joining ICF KE in 1989, he was regional manager of an environmental services company having major projects in precipitation monitoring, sampling and analysis, air monitoring and sampling, regulatory support to the USEPA and regulatory compliance consulting. He also provided management oversight to a full-service analytical laboratory. Mr. McKinney also has served as a project engineer responsible for solid, liquid and gaseous radioactive waste system design control and NRC licensing for a commercial nuclear reactor plant. He has performed waste characterization and disposal studies, system design modifications and radiation shielding calculations.

PROFESSIONAL AFFILIATIONS

American Institute of Chemical Engineers

American Nuclear Society

EMORY T. McLEAN

EDUCATION

1986 M.S.C.E., Environmental Engineering, University of Pittsburgh

1975 M.S., Biology, Clarion University of Pennsylvania

1973 B.S., Biology, University of Pittsburgh

EXPERIENCE

Emory T. McLean joined ICF Kaiser Engineers in 1979 and presently serves as a senior project manager. Mr. McLean has a considerable range of experience in the identification and mitigation of environmental effects and the identification and resolution of compliance issues associated with active and abandoned industrial operations and waste disposal facilities. He has directed or participated in projects solving problems in hazardous waste management and remediation, environmental engineering, water resources, biological impact investigations and regulatory agency support. Mr. McLean has recently performed engineering feasibility studies for the cleanup of private industrial facilities and sites under state and federal Superfund programs. On these projects, cleanup alternatives were formulated and evaluated for PCB and VOC contaminated soils, sediments and groundwater. He also developed hazardous waste technology fact sheets in support of EPA Region II community relations activities involving research to identify and collect available information on thermal, chemical and biological PCB treatment technologies to characterize operating characteristics, process flow diagrams and summarize the results and status of demonstration tests.

PROFESSIONAL AFFILIATIONS

American Society of Civil Engineers (ASCE)

RICHARD T. ZOLTUN

EDUCATION

1988 B.S., Environmental Engineering, The Pennsylvania State University

EXPERIENCE

As a Environmental Staff Engineer with ICF Kaiser Engineers, Mr. Zoltun has been heavily involved in writing technical reports and specifications and calculating cost data for a variety of environmental feasibility studies. His field experience includes site reconnaissance, soil gas sampling, surveying and well sampling. In addition, Mr. Zoltun has participated in evaluating remedial alternatives regarding costs, implementability and environmental impacts. Because of his proficiency in technical writing, he has authored or coauthored several feasibility study reports; he also participated in structuring a RCRA Part B Permit Application. Through experience and education, Mr. Zoltun is trained in the handling and disposal of hazardous wastes, water/wastewater treatment and air pollution abatement.

PROFESSIONAL AFFILIATION

American Society of Civil Engineers (ASCE)

SECTION 8.0

APPENDICES

APPENDIX A

ON-SITE WETLANDS CLASSIFICATIONS

APPENDIX A

DETAILED EXPLANATION

ONSITE WETLANDS CLASSIFICATIONS

This appendix presents wetland information as supplied by the National Wetlands Inventory done by the U.S. Department of the Interior's Fish and Wildlife Service. Excerpts are taken from the document Classification of Wetlands and Deepwater Habitats of the United States(FWS/OBS-79/31).

What are wetlands?

In general, wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. The single feature that most wetlands share is soil or substrate (underlying layer) that is at least periodically saturated with or covered by water. The water creates severe physiological problems for all plants and animals except those that are adapted for life in water or in saturated soil.

WETLANDS are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands must have one or more of the following attributes: (1) at least periodically, the land supports predominantly hydrophytes (plants growing in water which are periodically deficient of oxygen due to water contact); (2) the substrate is predominantly undrained hydric soil (soil wet long enough to produce anaerobic conditions); and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.

The term wetland includes a variety of areas that fall into five categories: (1) areas with hydrophytes and hydric soils, such as those commonly known as marshes, swamps and bogs; (2) areas without hydrophytes but with hydric soils - for example, flats where drastic fluctuation in water level, wave action, turbidity, or high concentration of salts may prevent the growth of hydrophytes; (3) areas with hydrophytes but with nonhydric soils, such as margins of impoundments or excavations where hydrophytes have become established but hydric soils have not yet developed; (4) areas without soils but with hydrophytes such as the seaweed covered portion of rocky shores; and (5) wetlands without soils and without hydrophytes, such as gravel beaches or rocky shores without vegetation.

Drained hydric soils that are now incapable of supporting hydrophytes because of a change in water regime are not considered wetlands by the U.S. Fish & Wildlife definition. These drained hydric soils furnish a valuable record of historic wetlands, as well as an indication of areas that may be suitable for restoration.

Lands that are identified under other categories in some land-use classification can also be defined as a wetland. For example, wetlands and farmlands are not necessarily exclusive. Many areas that are defined as wetlands are farmed during dry periods, but if they are not tilled or planted to crops, a practice that destroys the natural vegetation, they will support hydrophytes.

The upland limit of wetland is designated as (1) the boundary between land with predominantly hydrophytic cover and land with predominantly mesophytic (plants growing under average moisture conditions) or xerophytic (plants found in very dry habitats) cover; (2) the boundary between soil that is predominantly hydric and soil that is predominantly nonhydric; or (3) in the case of wetlands without vegetation or soil, the boundary between land that is flooded or saturated at some time during the growing season each year and land that is not.

The remainder of this appendix describes the wetland classifications which are found on-site at the RP&L facility.

System - Palustrine

Definition

The Palustrine System (Fig. A-1) includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses (wetland mosses generally not covered by water) or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5%. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres): (2) active wave-formed or bedrock shoreline features lacking: (3) water depth in the deepest part of the basin less than 2 meters at low water; and (4) salinity due to ocean-derived salts less than 0.5%.

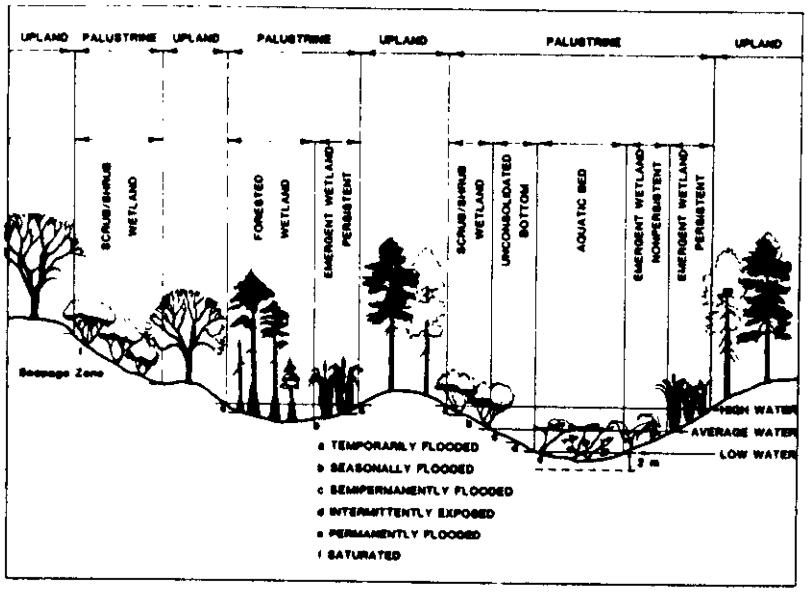


Figure A - Distinguishing features and examples of habitats in the Palustrine System.

Limits

The Palustrine System is bounded by upland or by any of the other four Systems (See Figure 3-4).

Description

The Palustrine System was developed to group the vegetated wetlands traditionally called by such names as marsh, swamp, bog, fen, and prairie, which are found throughout the United States. It also includes the small, shallow, permanent or intermittent water bodies often called ponds. Palustrine wetlands may be situated shoreward of lakes, river channels, or estuaries; on river floodplains; in isolated catchments; or on slopes. They may occur as islands in lakes or rivers. The erosive forces of wind and water are of minor importance except during severe floods.

The emergent vegetation (plants temporarily or permanently flooded at the base which do not tolerate prolonged inundation of the entire plant) adjacent to rivers and lakes is often referred to as "the shore zone" or the "zone of emergent vegetation" (Reid and Wood 1976), and is generally considered separately from the river or lake. As an example, Hynes (1970:85) wrote in reference to riverine habitats, "We will not here consider the long list of emergent plants which may occur along the banks out of the current, as they do not belong, strictly speaking, to the running water habitat." There are often great similarities between wetlands lying adjacent to lakes or rivers and isolated wetlands of the same class in basins without open water.

Subsystems

None.

Class - Unconsolidated Bottom

Definition

The Class Unconsolidated Bottom includes all wetland habitats with at least 25% cover of particles smaller than stones, and a vegetative cover less than 30%. Water regimes are restricted to subtidal, permanently flooded, intermittently exposed, and semipermanently flooded.

Description

Unconsolidated Bottoms are characterized by the lack of large stable surfaces for plant and animal attachment. They are usually found in areas with low energy and may be very unstable. Exposure to wave and current action, temperature, salinity, and light penetration determines the composition and distribution of organisms.

Most macroalgae (algae or groups of algae large enough to be visible without magnification) attach to the substrate by means of basal hold-fast cells or discs; in sand and mud, however, algae penetrate the substrate and higher plants can successfully root if wave action and currents are not too strong. Most animals in unconsolidated sediments live within the substrate and others may live on the surface, especially in coarse-grained sediments.

In the Palustrine System, there is usually high correlation, within a given water body, between the nature of the substrate and the number of species and individuals. For example, in the profundal (deep) bottom of eutrophic lakes where light is absent, oxygen content is low, and carbon dioxide concentration is high, the sediments are ooze-like organic materials and species diversity is low. Each substrate typically supports a distinct community of organisms (Reid and Wood 1976:262).

Water Regime Modifiers

Precise description of hydrologic characteristics requires detailed knowledge of the duration and timing of surface inundation, both yearly and long-term, as well as an understanding of groundwater fluctuations. Because such information is seldom available, the water regimes that, in part, determine characteristic wetland plant and animal communities are described here in only general terms. Water regimes are grouped under two major headings, Tidal and Nontidal.

Nontidal Modifiers are used for all nontidal parts of the Palustrine System.

Semipermanently Flooded

Surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface.

Intermittently Exposed

Surface water is present throughout the year except in years of extreme drought.

Special Modifiers

Many wetlands and deepwater habitats are man-made, and natural ones have been modified to some degree by the activities of man or beavers. Since the nature of these modifications often greatly influences the character of such habitats, special modifying terms have been included here to emphasize their importance. The Modifiers can be used singly or in combination wherever they apply to wetlands and deepwater habitats.

Excavated

Lies within a basin or channel excavated by man.

APPENDIX B

CONTACTS

ICF KAISER ENGINEERS

TELEPHONE MEMO

Call By: RTZ of: ICF KE Project Name & No.: LIFAC

Call To: IDEM of: ______ Phone No.: 317-232-8476

Subject: Whitewater River Chara. Date: 2-27-90 Time: 1430

ICF KE	Client	Telephone Conversation Contents (Summary of Discussions, Decisions, Commitments, Dates)
x		Yes, I'm trying to find information of stream
		quality testing for East Fork Whitewater River.
	x	O.K. I can help you. Sam Gibson speaking.
x		Hi Sam, do you do regular testing on EFWR
	x	Do quarterly fixed station monitoring at
		USGS gaging station below the only bridge in
		Abington, Indiana.
x		Do you have last years records and could
		you send it to me.
	x	We have it but its still only written in our
		log books -- no printed versions are available
		yet.
x		Could you read it to me over the phone?
	x	Sure, I guess so.
X		THE INFORMATION SAM CONVEYED WENT
		INTO TABLE ENTITLED "STREAM TESTING
		PARAMETERS"
		RTZ 3-22-90.

Distribution: ______

ICF KAISER ENGINEERS

TELEPHONE MEMO

Call By: RTZ of: ICF KE Project Name & No.: LIFAC

Call To: I.D.E.T. of: INDIANA DEPT. OF EMPLOYMENT & TRAINING Phone No.: 317-935-3619

Subject: EMPLOYMENT INFO Date: 3-5-90 Time: 1510

ICF KE	Client	Telephone Conversation Contents (Summary of Discussions, Decisions, Commitments, Dates)
x		Is there anyone there who can give me statistical information concerning employment opportunities and unemployment figures for Wayne County?
	x	Yes, let me put you through to Mark Beymer (Bēamer)
x		Thanks. Mark comes on and I ask him for the info above.
	x	In January 1990 the unemployment rate was 7.7% and the workforce breaks down as follows:
		45% manufacturing
		REST retail, proffessional and agricultural

Distribution: __________

ICF KAISER ENGINEERS

TELEPHONE MEMO

Call By RTZ of ICF KE Project Name & No.: LIFAC

Call To ______ of Sewar Authority Phone No.: 317-962-7956

Subject: Water & Wastewater Date: 3-7-90 Time: 1116

ICF KE	Client	Telephone Conversation Contents (Summary of Discussions, Decisions, Commitments, Dates)
x		I call and ask for information on the Wastewater
		Treatment Plant.
	x	You'll need to talk to Terry Kelly (male)
x		Thanks
	x	Hi Rick, the city of Richmond operates the
		WWTP and the plant discharges to the East
		Fork Whitewater River. Its a C4 plant
		utilizing activated sludge
x		What does C4 stand for?
	x	Means Class 4 - serving a population 30000 - 40000.
x		How about drinking water?
	x	Middle Fork Reservoir supplied by AWW
x		Any wells?
	x	Yes, I think they use them.
x		thanks Terry

Distribution: ______

ICF KAISER ENGINEERS

TELEPHONE MEMO

Call By: RTZ of ICF KE Project Name & No.: LIFAC

Call To: INDR of ______ Phone No.: 317-232-4164

Subject: FLOODPLAIN INFORMATION Date: 3-7-90 Time: 1518

ICF KE	Client	Telephone Conversation Contents (Summary of Discussions, Decisions, Commitments, Dates)
x		Call Indiana Department of Natural Resources
		and put through to Burton Danials... Does your
		office distribute floodplain maps? For Richmond?
	x	Yes we do but they go by streams name.
x		O.K. How about the East Fork Whitewater River?
	x	What section? The entire EFWR map uses
		15 maps.
x		We discuss location and agree on 3 maps
		which cover the section from National Road
		downstream to the Short Creek confluence. i
		ask for copies.
	x	We'll send them out at $1.50/ea.
x		Thanks -- could you quickly tell me the
		100 yr. flood levels near the RP&L
		property?
	x	Todd Stevenson will need to tell you this.
x		O.K
	x	Hi Rick - Test Road = 871.4' and 2000' Feet
		downstream = 866.4'
x		Thanks Scott
		1525

Distribution: ______

ICF KAISER ENGINEERS

TELEPHONE MEMO

Call By RTZ of ICF KE Project Name & No.: LIFAC

Call To Surveyor of Phone No.: 317-973-9200

Subject: Wayne County Date: 3-19-90 Time: 1600

ICF KE	Client	Telephone Conversation Contents (Summary of Discussions, Decisions, Commitments, Dates)
x		Call the county surveyor's office and talk
		to Arlene Wackler. What is the total
		area of the county?
	x	She looks... 411 mi^2
x		Great! Do you have aerial photos
		there?
	x	Yes we do but you will need to
		talk to Bob Henkowski
x		Hi Bob, I'd like to get some aerial
		photos of the RP&L property.
	x	O.K Rick. I can send you a 1" = 400'
		blueline but you might be better off
		contacting Andy Boatwright at RP&L as
		they had some special 1" = 200' maps made
		up a while back.
x		Thanks Bob -- I'll do that.
	x	Where do I send this?
x		I give Bob info and ask him to send
		complete references for photographs
	x	They were taken by Wolford Consultents
		in Dayton...

Distribution:

ICF KAISER ENGINEERS

TELEPHONE MEMO

Call By RTZ of ICF KE Project Name & No.: LIFAC

Call To Warren McFay of IDEM Phone No.: 317-232-8344

Subject: Weather Information Date: 3-22-90 Time: 1240

ICF KE	Client	Telephone Conversation Contents (Summary of Discussions, Decisions, Commitments, Dates)
x		Hi Warren, I've been waiting for climatological data from Mark Strimbu for two weeks and it not here; now I'm in a "act now" situation and I need precipitation data. Can you read me some annual rainfall volumes for Dayton?
	x	Sure, these are from NOAA monthly summaries for Dayton (LCO):
		1988 36.5 in
		1987 thrown out - drought year
		1986 42.9 in
		1985 35.8 in
		1984 35.9 in
		1983 37.8 in
		1982 42.7 in
		1981 43.6 in
		1980 40.9 in
		1979 43.3 in
		1978 39.0 in
x		Thanks Warren
	x	OK -- I'll remind Mark
x		Good -- Take care

Distribution:

ICF KAISER ENGINEERS

TELEPHONE MEMO

Call By: RTZ of ICF Project Name & No.: LIFAC

Call To: Don Cochran of Ball State Phone No.: 317-285-5328

Subject: Archeological Information Date: 3-22-90 Time: 1400

ICF KE	Client	Telephone Conversation Contents (Summary of Discussions, Decisions, Commitments, Dates)
x		I ask about archeological sites in a five mile radius of the powerplant. I have heard that Ball State Muncey has done some work in Richmond defining sites.
	x	We have surveyed some of the area but usually requests like this are done in writing and a records search is done by us.
x		I ask for verbal verification now followed by a formal request soon.
	x	Yes there are lots of sites.
x		O.K. How about in a 1 mile radius?
	x	What quad sheet is that?
x		Richmond
	x	Alright, I'll let you know how many are in the quad sheet blocks surranding the powerplant.
x		O.K. its just south of the city limits
	x	I see it:
		block 6 - 6 sites block 9 - 0 sites
		" 7 - 6 " " 4 - 0 sites
		" 18 - 7 " " 5 - 0 "
		" 17 - 0 " " 8 - 1 "
		" 16 - 0 "

Distribution: CONTINUED

ICF KAISER ENGINEERS

TELEPHONE MEMO

Call By: RTZ of ICF KE Project Name & No.: LIFAC

Call To: D. Cochran of Ball State Phone No.:

Subject: Archeological Info Continued Date: Time:

ICF KE	Client	Telephone Conversation Contents (Summary of Discussions, Decisions, Commitments, Dates)
x		I need your address to send the request
	x	Department of Anthropology
		Ball State University
		Muncey, Indiana 47306
x		What do I use as a reference for information
		you just gave me?
	x	Archeological Resource Management Services
		Ball State University
		Ect.
x		Thanks for your time Don
	x	Your Welcome Rick

Distribution:

ICF KAISER ENGINEERS

TELEPHONE MEMO

Call By: Rick Zoruml of ICF Kaiser Project Name & No.: LIFAC 31331 EIV

Call To: Mr. Cock of Southside Landfill Phone No.: 317-247-6808

Subject: Landfill Characteristics Date: MAY 9, 1990 Time: 11:07 am

Rick	Client	Telephone Conversation Contents (Summary of Discussions, Decisions, Commitments, Dates)
x		We discuss who I am and why I'm calling for a couple minutes until Mr. Cock is sure who I am.
x		Can you tell me about the size, useful life remaining and daily landfill waste volumes accepted?
	x	The landfill is 240 acres with 15-20 years of remaining useful life at our present fill rate which is about 5000 cy / day. This number fluctuates but 5000 yards is probably a good estimate
x		Thanks Mr. Cock
	x	Your welcome.

Distribution: ____________

ICF KAISER ENGINEERS

TELEPHONE MEMO

Call By: Rick Zoltun of ICF Kaiser Engr. Project Name & No.: LIFAC 31331 EIV

Call To: Middlefork Reservoir of Richmond, IN Phone No.: 317-983-7293

Subject: Reservoir Date: MAY 4, 1990 Time: 3:15 pm

Rick	Client	Telephone Conversation Contents (Summary of Discussions, Decisions, Commitments, Dates)
x		Talk to Dan at the reservoir. I explain who I am and what I'm doing
x		whats the surface area of the reservoir?
	x	117 acres with a possible rise of 12-14 feet. It dropped 15 feet during the drought a few years back but its pretty deep so it could handle it.
x		How deep?
	x	60 feet in some parts
x		Who operates the reservoir?
	x	IAW owns it, the parks & recreation office operates it.
x		What type of fish are in the reservoir?
	x	blue gill, crappie, lm bass, n. pike, channel cat
x		Do you know what fish are in East Fork Whitewater
	x	Sure. blue gill, crappie and sm bass are the most abundant. April/May are the big fishing months
x		Thanks Dan
	x	Your certainly Welcome.

Distribution: ____________________

ICF KAISER ENGINEERS

TELEPHONE MEMO

Call By: RICK Z. of: ICF KAISER Project Name & No.: LIFAC 31331-A

Call To: R. McQUIRE of: RICHMOND MUNICIPAL LANDFILL Phone No.: 317-962-2828

Subject: LANDFILL CHARACTERISTICS Date: MAY 3, 1990 Time: 2:30 pm

Rick	Client	Telephone Conversation Contents (Summary of Discussions, Decisions, Commitments, Dates)
x		Hi Rick, I have a few more questions
	x	Shoot Rick
x		What is the surface area of the landfill and the
		planned new cells and how long will each last?
	x	The old landfill has 1-2 years left of useful life
		and covers about 90 acres. Its permit expires 8-90.
		The new cells, three of them will last 18 years
		and cover 40-45 acres.
x		How much waste do you take in each day?
	x	350-400 tons
x		What material are you permitted to take?
	x	Solid waste
x		How about what they designate as "special" waste?
	x	No
x		How did you handle LIMB waste?
	x	Mixed it with wastewater treatment plant
		sludge and then into the trash.
x		Thanks Rick
	x	Sure.

Distribution: ______

ICF KAISER ENGINEERS

TELEPHONE MEMO

Call By: RICK Z. of ICF KE Project Name & No.: LIFACE IV 31331

Call To: RANDOLPH FARMS LANDFILL of MODOC, INDIANA Phone No.: 317-853-5714

Subject: LANDFILL CHARACTERISTICS Date: MAY 9, 1990 Time: 8:34 am

RICK	Client	Telephone Conversation Contents (Summary of Discussions, Decisions, Commitments, Dates)
		(REWRITTEN NOTES FROM SCRATCH PAPER)(MAY 3, 1990)
x		I CONTACT GARY FINE AT THE LANDFILL AND
		RECIEVE THE FOLLOWING INFORMATION:
		1. REMAINING USEFUL LIFE?
		STATE OF INDIANA ESTIMATES 15 YEARS.
		LANDFILL OPERATERS FEEL 12 YEARS IS
		A BETTER ESTIMATE
		2. WASTE VOLUME INTO LANDFILL TYPICALLY?
		1500-2500 CY/DAY
		3. MATERIALS PERMITTED FOR ACCEPTANCE?
		SOLID WASTES
		SPECIAL WASTES
		NO HAZARDOUS
		4. HOW DO YOU FILL?
		2' COMPACTED INTERVALS; 2-3 OF THESE
		EACH DAY WITH 6" OF DAILY COVER.
		5. DO YOU TAKE ANY FLY ASH PRESENTLY?
		NO
		6. LANDFILL SURFACE AREA?
		120 ACRES

Distribution: ______

ICF KAISER ENGINEERS

TELEPHONE MEMO

Call By: Rick Zoltun of: ICF Kaiser Project Name & No.: LIFAC 31331-000-00

Call To: Sam Gibson of: IDEM Phone No.: 317-243-5042

Subject: Metals Testing Date: 5-9-90 Time: 4:10 PM

Rick	Client	Telephone Conversation Contents (Summary of Discussions, Decisions, Commitments, Dates)
x		Reintroduce myself to Sam. I ask him about metals sampling for the East Fork Whitewater River.
	x	I believe metals testing is done but I'll need to check when and at what stations on the river.
x		Thanks Sam - call me back
	x	Calls back at 4:40 pm. I have points upstream and downstream of the wastewater treatment plant.
x		Great
	x	Upstream point is at test road, downstream at the ford in the river shown on quadrangle.
x		OK, I see the spots
	x	The data is given in micrograms/L except cyanide which is in milligrams/L
x		OK, lets have it Sam!
	x	Right-O Rick:
		DATA HE YIELDS IS INCLUDED IN THE TABLE ENTITLED "STREAM TESTING PARAMETERS.

Distribution: ____________

ICF KAISER ENGINEERS

TELEPHONE MEMO

Call By: Rick Zoltun of: ICF KE Project Name & No.: LIFAC EIV 31331

Call To: Eric Keller of: Ash Management Phone No.: 304-755-0524

Subject: RP&L Ash Use Date: May 15, 1990 Time: 2:15 PM

Rick	Client	Telephone Conversation Contents (Summary of Discussions, Decisions, Commitments, Dates)
x		Dale Norris of RP&L suggests I call Eric to get info. on the ash sales at RP&L in the past. I call and explain my question to Eric.
	x	Its be a couple years since we were in the Indiana market but we are making efforts there now. I Know 3-4 months worth of Unit 2 ashs were purchased by another company a while back but troubles with the company ended that. The boiler ash market is exploratory in nature and although no substantial strides have been made, efforts are underway. the fields of interest are environmental (stabalization), redimix concrete products and fill.
x		Do you Know any RP&L ash info off the top of your head.
	x	Yes. Unit 2 produces about 19-20,000 tons/yr of ash with a dry density of ~70 lbs/ft. Min 55 lb/ft, max compacted 80 lbs/ft and with moisture add 10-15% by wt. SG = 2.5
x		We talk about environmental issues for awhile and I thank Eric....
	x	Your welcome Rick, call me if you have any other questions

Distribution:

ICF KAISER ENGINEERS

TELEPHONE MEMO

Call By: RTZ of ICF KE Project Name & No.: LIFAC 91001-002-00

Call To: BILL REYNOLDS of RICHMOND SANITY DIST. Phone No.: 317-962-2828

Subject: DUBNER'S DITCH Date: 9-4-90 Time: 5:19 PM EST

ICF KAISER	Client	Telephone Conversation Contents (Summary of Discussions, Decisions, Commitments, Dates)
x		I CALL THE SANITARY DISTRICT TO ASK BILL ABOUT
		DUBNER'S DITCH AND WHAT AREA OF RICHMOND
		THIS DRAINAGE CHANNEL SERVICES.
	x	YES I'M FAMILAR WITH THE DITCH, IT IS FED BY
		A 72 INCH TILE PIPE WHICH COMES DOWN FROM
		THE NORTHEND OF TOWN -- IT SERVES AS A
		STORM DRAIN FOR QUITE AN AREA. I WAS JUST
		DOWN THERE LAST NIGHT WORKING ON AN OIL SPILL.
x		COULD YOU ESTIMATE RP&L'S CONTRIBUTION TO THE
		STREAM (FLOW IN DUBNER'S DITCH)?
	x	WE'VE NEVER REALLY MEASURED IT BUT I'D GUESS
		SOMEWHERE IN THE NEIGHBORHOOD OF 1/6-1/5 OF
		THE TOTAL FLOW.
x		DOES THE DITCH EVER DRY UP?
	x	I'VE NEVER SEEN IT DRY.
		RUNNING 2 1/2" DEEP
		2' WIDE

Distribution: ____________

Division of Nature Preserves
605B State Office Building
Indianapolis, Indiana 46204-2267
317-232-4052

April 4, 1990

Richard T. Zoltun
ICF Kaiser Engineers
Robinson Plaza II, Suite 200
Pittsburgh, PA 15205-1017

Dear Mr. Zoltun:

I am responding to your request for information on the endangered, threatened, or rare species found in the vicinity of Richmond, Indiana. The Indiana Natural Heritage Program's databank has been checked and enclosed is a list of state and federally listed species found in the area. I have also included high quality natural communities and natural areas. The dates provided on the list refer to the year in which the species or community was last observed.

You may also wish to contact the Wayne County Resources Inventory Council, Inc. They may be able to provide you with more information on that area. Contact:

Virginia Schussler
5187 Greenmount Road
Richmond, IN 47374

The information I am providing does not preclude the requirement for further consultation with the U.S. Fish and Wildlife Service as required under Section 7 of the Endangered Species Act of 1973. You should contact the Service at their Bloomington, Indiana office.

U.S. Fish and Wildlife Service
718 North Walnut
Bloomington, Indiana 47401
(812)334-4261

At some point, you may need to contact the Department of Natural Resources' Environmental Review Coordinator so that other divisions within the department have the opportunity to review your proposal. Please refer to the enclosed Environmental Review Guidelines. For more information, please contact:

Patrick R. Ralston, Director
Department of Natural Resources
attn: Steve Jose
Environmental Review Coordinator
605 State Office Building
Indianapolis, IN 46204
(317)232-4070

I have enclosed an invoice for $30.00 to cover the cost of the request.

Thank you for contacting the Indiana Natural Heritage Program. Please contact me if you have any questions or need additional information.

Sincerely,

Michelle L. Martin

Michelle L. Martin
Indiana Natural Heritage Program

enclosures

ENDANGERED, THREATENED, AND RARE SPECIES
AND HIGH QUALITY NATURAL COMMUNITIES AND NATURAL AREAS
LOCATED NEAR RICHMOND, INDIANA

se=endangered, st=threatened, sr=rare, ssc=special concern, wl=watch list, ur=under review
le=endangered, c2=category 2 (may be appropriate to list), 3c=category 3 (more abundant than previously believed)

STATE STAT	SNAME	COMMON NAME	FED STAT	TWP/RANGE	SEC	DATE
Fairhaven Quadrangle						
none						
Fountain City Quadrangle						
NATURAL AREA - LEWIS WOODS:						
WL	ARDEA HERODIAS	GREAT BLUE HERON		017N014E	08	1987
	FOREST - UPLAND MESIC	MESIC UPLAND FOREST		017N014E	08	1985
SE	MYOTIS SODALIS	INDIANA OR SOCIAL BAT	LE	017N014E	14	1987
SE	NOTROPIS ARIOMMUS	POPEYE SHINER		017N014E	22	1971
	WETLAND - SWAMP SHRUB	SHRUB SWAMP		018N014E	21	1985
Liberty Quadrangle						
WHITEWATER STATE PARK FOUND IN UNION COUNTY						
NATURAL AREA - SEDGEWICK'S ROCK PRESERVE:						
	FOREST - UPLAND DRY-MESIC	DRY-MESIC UPLAND FOREST		013N001W	31	1969
	PRIMARY - CLIFF LIMESTONE	LIMESTONE CLIFF		013N001W	31	1969
ST	WALDSTEINIA FRAGARIOIDES	BARREN STRAWBERRY		013N001W	31	1987
SE	NYCTICORAX NYCTICORAX	BLACK-CROWNED NIGHT-HERON		015N002W	02	1972
SR	JUNIPERUS COMMUNIS	GROUND JUNIPER		012N001W	05	1981
WL	PANAX QUINQUEFOLIUS	AMERICAN GINSENG	3C	012N001W	31	1988
New Paris Quadrangle						
NATURAL AREA - ELKHORN FALLS				013N001W	22	
NATURAL AREA - HAYES ARBORETUM:						
SR	PYCNOPSYCHE ROSSI	A NORTHERN CASEMAKER CADDISFLY		014N001W	35	1980
SE	BARTRAMIA LONGICAUDA	UPLAND SANDPIPER		013N001W	26	1988
SR	JUNIPERUS COMMUNIS	GROUND JUNIPER		013N001W	11	1929
SR	RHAMNUS LANCEOLATA	LANCE-LEAVED BUCKTHORN		013N001W	11	1989
SE	SATUREJA GLABELLA VAR ANGUSTIFOLIA	CALAMINT		013N001W	11	1918
ST	SPIRANTHES LUCIDA	SHINING LADIES'-TRESSES		013N001W	11	1978

ENDANGERED, THREATENED, AND RARE SPECIES
AND HIGH QUALITY NATURAL COMMUNITIES AND NATURAL AREAS
LOCATED NEAR RICHMOND, INDIANA

se=endangered, st=threatened, sr=rare, ssc=special concern, wl=watch list, ur=under review
le=endangered, c2=category 2 (may be appropriate to list), 3c=category 3 (more abundant than previously believed)

Richmond Quadrangle

STATE STAT	SNAME	COMMON NAME	FED STAT	TWP/RANGE	SEC	DATE
ST	CLONOPHIS KIRTLANDII	KIRTLAND'S SNAKE	C2	013N001W	20	1985
ST	CLONOPHIS KIRTLANDII	KIRTLAND'S SNAKE	C2	016N001W	29	1985
ST	CLONOPHIS KIRTLANDII	KIRTLAND'S SNAKE	C2	013N001W	06	1959
SSC	IXOBRYCHUS EXILIS	LEAST BITTERN		016N014E	29	1964
SE	MYOTIS SODALIS	INDIANA OR SOCIAL BAT	LE	016N014E	29	1957
SE	RALLUS ELEGANS	KING RAIL		016N014E	33	1960
SE	TYTO ALBA	COMMON BARN-OWL		014N001W	32	1959
	FOREST - UPLAND DRY	DRY UPLAND FOREST		016N014E	33	1969
	WETLAND - FEN	FEN		013N001W	07	1988
WL	PANAX QUINQUEFOLIUS	AMERICAN GINSENG	3C	013N002W	24	1988
WL	PANAX QUINQUEFOLIUS	AMERICAN GINSENG	3C	016N014E	27	1988
ST	VIBURNUM MOLLE	SOFTLEAF ARROW-WOOD		015N002W	24	1987
ST	WALDSTEINIA FRAGARIOIDES	BARREN STRAWBERRY		013N001W	31	1987
ST	WALDSTEINIA FRAGARIOIDES	BARREN STRAWBERRY		016N014E	33	1963
ST	WALDSTEINIA FRAGARIOIDES	BARREN STRAWBERRY		014N001W	29	1988

Whitewater Quadrangle

none

Ball State University

Department of Anthropology
Archaeological Resources Management Service

April 19, 1990

Richard T. Zoltun
ICF Kaiser Engineers
Robinson Plaza II, Suite 200
Pittsburgh, PA 15205-1017

Dear Mr. Zoltun:

Enclosed are the results of your recent records check. It is our recommendation that the project be allowed to proceed without any further archaeological investigation, keeping in mind the comments contained in the recommendations section of the records check. If we can be of any further service to you please feel free to contact us.

Sincerely,

Mitch Zoll

Mitch Zoll
Coordinator of Contract
Archaeology

MZ:jm

317-285-5328 Muncie, Indiana 47306-0435

Archaeological Records Review

Richmond Power & Light

Wayne County, Indiana

prepared for

ICF Kaiser Engineers

April 11, 1990

Prepared by

Allyson Bennett

Donald R. Cochran
Principal Investigator

Archaeological Resources Management Service
Ball State University
Muncie, Indiana
47306

Introduction

In response to a request from ICF Kaiser Engineers, an archaeological records check has been completed for an Environmental Information Volume for Richmond Power and Light located approximately 1/2 mile from Richmond, Wayne County, Indiana (Figure 1). The project is located in the NW 1/4 of the SW 1/4 of the SE 1/4 of Section 8, Township 13 North, Range 1 West as shown on the USGS 7.5' Richmond, Indiana Quadrangle (Figure 2). The proposed project involves a demonstration of a retrofit flue gas desulfuration technology at the existing Richmond Power and Light plant site.Land within the project area is presently disturbed. No new permanent or temporary right-of-way will be required for this project.

The records check utilized site records, maps and materials on file in the ARMS laboratory to locate, identify and evaluate the known and expected cultural resources within the project area. The records search was conducted at a level specific to the project area; where no record of sites were found, the search was broadened to include the county and/or region to evaluate the potential impact of the project upon archaeological resources.

Setting

The project area was located in the bedrock physiographic unit known as the Dearborn Upland (Schneider 1966:54), an area underlain by Ordovician rocks (Gutschick 1966:3, 5). Surface deposits in the area were within the Butlerville Till Member of the Jessup Formation (Wayne 1966:26) and within the general physiographic unit known as the Dearborn Upland (Schneider 1966:41). Soils within the project area consisted of the nearly level to moderately sloping, deep and somewhat excessively drained Orthents, loamy (Or) (Blank 1987:35; Map Sheet 43). The presettlement vegetation of the area was beech-maple forest (Petty and Jackson 1966:280). The project was located in the Till Plain environmental zone (Gray 1972).

Background

Information on file at the archaeology laboratory at Ball State University shows that 257 archaeological sites have been recorded for Wayne County. Seven of the sites are within one mile of the proposed project area. Archaeological bibliographies (Michael 1969, Akard 1979) contain 11 references to archaeological resources in Wayne County, but no sites were listed for the project area. Guernsey (1932) shows the town of Richmond near the project area. A search of the General Land Office records for Wayne County shows an Indian road within 2 1/2 miles of the project area. The map of Wayne County in Maps of Indiana Counties in 1876 (Anonymous 1968) shows the towns of Richmond, Greenwood, South Richmond, three mills, a farmhouse, and a cemetery within one mile of the project area. Wepler (1980, 1984) shows no Delaware or Miami sites near the project area. Our records do not show that the area under consideration

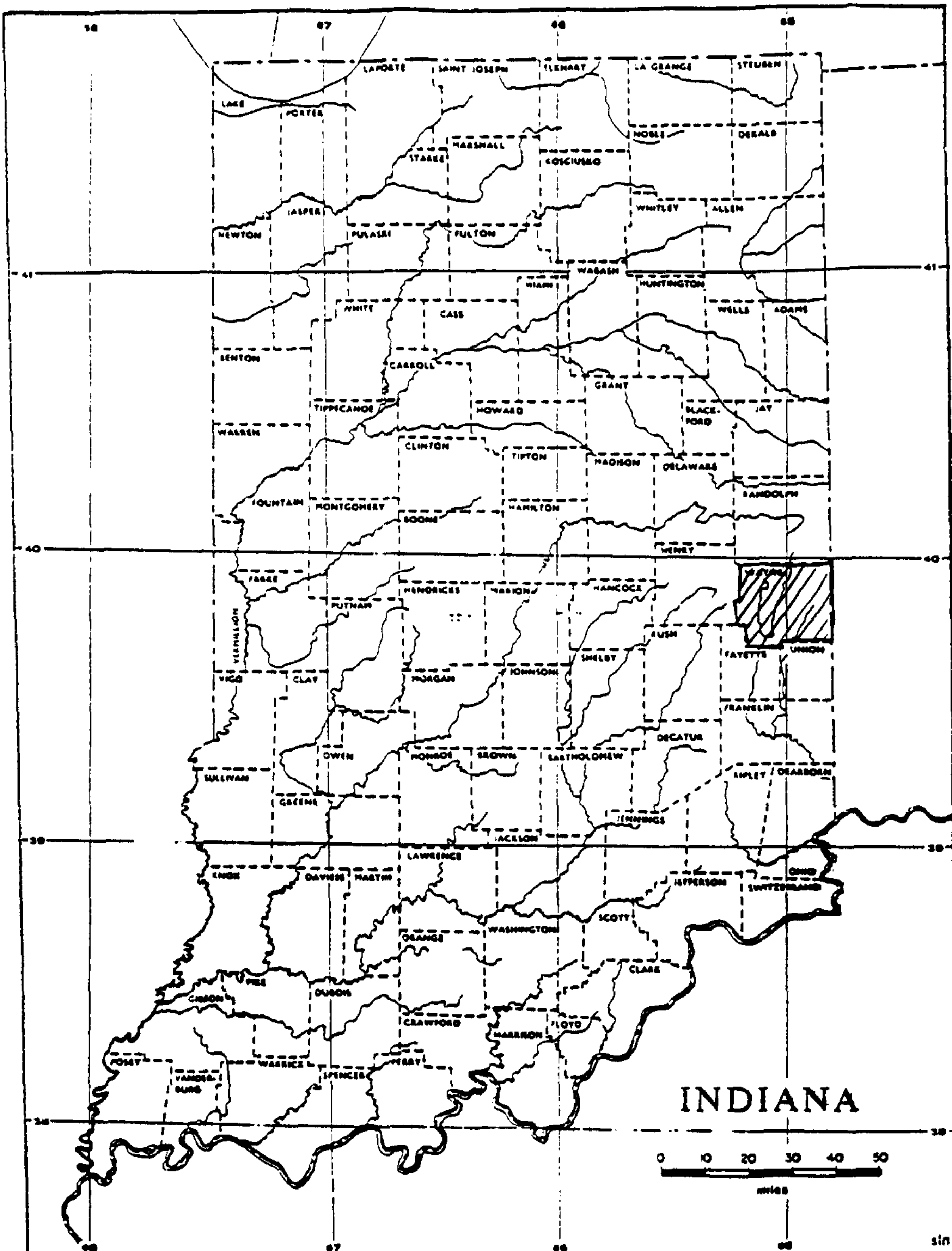


Figure 1: Location of Wayne County within the state.

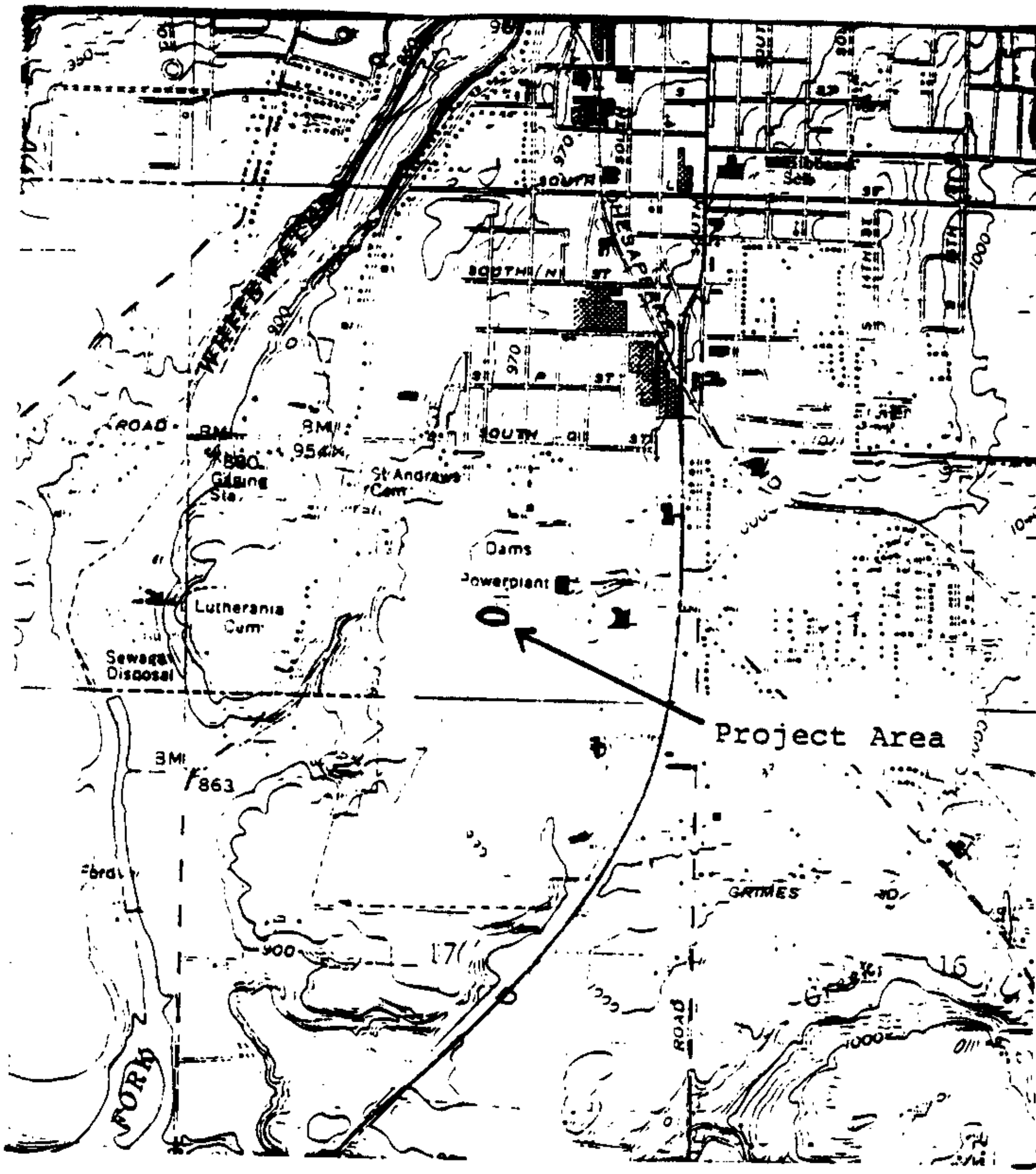


Figure 2: Portion of the USGS 7.5' Richmond, Indiana Quadrangle showing the project location.

has been covered by an archaeological reconnaissance. No site density predictive data has been compiled for the region.

Recommendations

Given that no new land will be required for the project and the likelihood that the existing land has been extensively disturbed, no further archaeological assessment is recommended. If artifact concentrations, archaeological features or burials are encountered during construction, the project must be halted and the archaeologist in the Division of Historic Preservation and Archaeology contacted for an evaluation before the project resumes.

References Consulted

Akard, William K.
1979 An annotated bibliography of Indiana Archaeology 1968-1979. Ball State University Archaeological Reports No. 15. Muncie: Ball State University.

Anonymous
1968 Maps of Indiana Counties in 1876. Indianapolis: Indiana Historical Society.

Bushnell, T.M.
1925 Soil Survey of Wayne County, Indiana. Washington, D.C.: U.S. Department of Agriculture.

General Land Office Surveys
1795-1840 Microfilm for Indiana on file, Archaeological Resources Management Service, Ball State University, Muncie, Indiana.

Gray, H.H. et al
1972 Geologic Map of the Cincinnati Quadrangle. Indianapolis: Department of Natural Resources, State of Indiana.

Guernsey, E.Y.
1932 Indiana: the influence of the Indian upon its history... (map). Indianapolis: Department of Conservation, State of Indiana.

Gutschick, Raymond C.
1966 Bedrock geology. In Lindsey 1966, pp. 1-20.

Lindsey, Alton A., ed.
1966 Natural features of Indiana. Indianapolis: Indiana Academy of Science.

Michael, Ronald L.
1969 Bibliography of literature on Indiana Archaeology. Ball State University Archaeological Reports No. 5. Muncie: Ball State University.

Petty, R.O. and Jackson, M.T.
1966 Plant Communities. In Lindsey 1966, pp. 264-296.

Schneider, Allen F.
1966 Physiography. In Lindsey 1966, pp. 40-56.

Wayne, William J.
1966 Ice and land. In Lindsey 1966, pp. 21-39.

Wepler, William R.
1980 Historical Delaware (Lenape) Villages in Indiana. MS on file at Archaeological Resources Management Service. Muncie: Ball State University.

1984 Miami Occupation of the Upper Wabash Drainage: A Preliminary Study Unit. Reports of Investigation 16. Archaeological Resources Management Service. Muncie: Ball State University.

APPENDIX C

PERMITS

OFFICE OF AIR MANAGEMENT
INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

PROPOSED OPERATION PERMIT

DRAFT

Richmond Power and Light
2000 U.S. 27 South
Richmond, Indiana

has applied for authorisation to operate:

the facilities associated with the fuel and ash handling systems, serving the coal-fired boilers.

It is proposed to issue this permit under provisions of 326 IAC Article 2 with the following conditions:

Pending Identification No. 89-09-94-0207

Expiration Date September 1, 1994

THIS IS NOT A PERMIT

1. That the data and information supplied in the application shall be considered part of this permit. Prior to <u>any</u> change in the operation which may result in an increase in potential emissions exceeding those specified in 326 IAC 2-1-1, this change must be approved by the Office of Air Management.

2. That the permittee shall comply with the provisions of the Indiana Environmental Management Law (IC 13-7), Air Pollution Control Law (IC 13-1-1) and the rules promulgated thereunder.

3. That the equipment shall be operated and maintained in accordance with the manufacturer's specifications.

4. That fugitive dust emissions shall comply with 326 IAC 6-4.

OFFICE OF AIR MANAGEMENT
INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

PROPOSED OPERATION PERMIT

DRAFT

Richmond Power and Light
2000 U.S. 27 South
Richmond, Indiana

has applied for authorisation to operate:

the dry bottom, pulverised coal-fired boiler (Unit #2), rated at 616 million Btu's per hour heat input, used to generate electricity. Particulate emissions are controlled by an electrostatic precipitator. Controlled boiler emissions are exhausted to the atmosphere through a 325 foot (above grade) stack shared with Unit #1, with a 141 inch exit diameter.

It is proposed to issue this permit under provisions of 326 IAC Article 2 with the following conditions:

Pending Identification No. 89-09-94-0206

Expiration Date September 1, 1994

THIS IS NOT A PERMIT

1. That the data and information supplied in the application shall be considered part of this permit. Prior to any change in the operation which may result in an increase in potential emissions exceeding those specified in 326 IAC 2-1-1, this change must be approved by the Office of Air Management.

2. That the permittee shall comply with the provisions of the Indiana Environmental Management Law (IC 13-7), Air Pollution Control Law (IC 13-1-1) and the rules promulgated thereunder.

3. That the equipment shall be operated and maintained in accordance with the manufacturer's specifications.

4. That pursuant to 326 IAC 6-1-14, particulate matter emissions to the atmosphere from the unit shall be limited to 0.07 pounds per million Btu's of heat input.

5. That visible emissions shall be limited to 40% opacity pursuant to 326 IAC 5-1-2(a)(1) for attainment areas.

6. That pursuant to 326 IAC 7-1-11(a)(9), sulfur dioxide emissions shall be limited to 6.0 pounds per million Btu's of heat input.

7. That the plant shall sample and analyse coal on a daily basis. (Note: analysis based on composite samples for weekends and holidays will be acceptable.) The above analysis shall include all of the following on an "as burned" basis: heat content and percent sulfur. Records of the analysis shall be retained at the plant and be made available for at least the past 36 month period. Reports of the daily and 30 day rolling weighted average sulfur dioxide emission rates in pounds per million Btu of heat input for each day shall be submitted on a quarterly basis by the end of the month following the quarter to the Office of Air Management.

8. That pursuant to 326 IAC 3-1, an instrument for continuous monitoring and recording of opacity from the Units 1 and 2 combined stack shall be calibrated, maintained and operated. Exceedances of the opacity limit based on continuous emissions monitoring data shall be reported to the OAM on a quarterly basis. The averaging period for data reporting shall be 6 minutes, and a cause for each exceedance shall be given. This report shall be reported within 30 days of the end of the quarter.

9. That pursuant to 326 IAC 2-1-4(e), a stack test to determine particulate matter emissions from Unit 2 shall be conducted during calendar year 1990, and again during calendar years 1992 and 1994. The OAM shall be notified of the test date in advance pursuant with 326 IAC 3-2-3 and the test report shall be submitted to the OAM within 45 days of the test. Continuous opacity emission monitor data recorded during the test shall be submitted with the test report.

10. That pursuant to 326 IAC 5-1-3(d), a special exemption is hereby granted to allow, when necessary, the following visible stack emissions during Unit 2 startups and shutdowns:

    (a) During boiler startups, an exemption from the 40% opacity limit is allowed for up to 35 (thirty-five) six minute average periods. During these startup periods, all reasonable efforts shall be made to minimise the number and magnitude of the exceedances.

    (b) During boiler shutdowns, an exemption from the 40% opacity limit is allowed for up to 3 (three) six minute average periods, with none of the averages to exceed 80%.

OFFICE OF AIR MANAGEMENT
INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

DRAFT

PROPOSED OPERATION PERMIT

Richmond Power and Light
2000 U.S. 27 South
Richmond, Indiana

has applied for authorization to operate:

the dry bottom, pulverized coal-fired boiler (Unit #1), rated at 385 million Btu's per hour heat input, used to generate electricity. Particulate matter emissions are controlled by an electrostatic precipitator. Controlled boiler emissions are exhausted to the atmosphere through a 325 foot (above grade) stack shared with Unit #2, with a 141 inch exit diameter.

It is proposed to issue this permit under provisions of 326 IAC Article 2 with the following conditions:

Pending Identification No. 89-09-94-0205

Expiration Date September 1, 1994

THIS IS NOT A PERMIT

1. That the data and information supplied in the application shall be considered part of this permit. Prior to any change in the operation which may result in an increase in potential emissions exceeding those specified in 326 IAC 2-1-1, this change must be approved by the Office of Air Management.

2. That the permittee shall comply with the provisions of the Indiana Environmental Management Law (IC 13-7), Air Pollution Control Law (IC 13-1-1) and the rules promulgated thereunder.

3. That the equipment shall be operated and maintained in accordance with the manufacturer's specifications.

4. That pursuant to 326 IAC 6-1-14, particulate matter emissions to the atmosphere from the unit shall be limited to 0.04 pounds per million Btu's of heat input.

5. That visible emissions shall be limited to 40% opacity pursuant to 326 IAC 5-1-2(a)(1) for attainment areas.

6. That pursuant to 326 IAC 7-1-11(a)(9), sulfur dioxide emissions shall be limited to 6.0 pounds per million Btu's of heat input.

7. That the plant shall sample and analyze coal on a daily basis. (Note: analysis based on composite samples for weekends and holidays will be acceptable.) The above analysis shall include all of the following on an "as burned" basis: heat content and percent sulfur. Records of the analysis shall be retained at the plant and be made available for at least the past 36 month period. Reports of the daily and 30 day rolling weighted average sulfur dioxide emission rates in pounds per million Btu of heat input for each day shall be submitted on a quarterly basis by the end of the month following the quarter to the Office of Air Management.

8. That pursuant to 326 IAC 3-1, an instrument for continuous monitoring and recording of opacity from the Units 1 and 2 combined stack shall be calibrated, maintained and operated. Exceedances of the opacity limit based on continuous emissions monitoring data shall be reported to the OAM on a quarterly basis. The averaging period for data reporting shall be 6 minutes, and a cause for each exceedance shall be given. This report shall be reported within 30 days of the end of the quarter.

Richmond Power and Light
2000 U.S. 27 South
Richmond, Indiana
89-09-94-0205

9. That pursuant to 326 IAC 2-1-4(e), a stack test to determine particulate matter emissions from Unit 1 shall be conducted during calendar year 1990, and again during calendar years 1992 and 1994. The OAM shall be notified of the test date in advance pursuant with 326 IAC 3-2-3 and the test report shall be submitted to the OAM within 45 days of the test. Continuous opacity emission monitor data recorded during the test shall be submitted with the test report.

10. That pursuant to 326 IAC 5-1-3(d), a special exemption is hereby granted to allow, when necessary, the following visible stack emissions during Unit 1 startups and shutdowns:

    (a) During cold boiler startups, an exemption from the 40% opacity limit is allowed for up to 80 (eight) six minute average periods. During warm boiler startups, an exemption is allowed for up to 45 (forty-five) six minute average periods. A cold startup shall be defined as one after which the unit has been off-line for 48 (forty-eight) hours or more, and a warm startup as one after which the unit has been off-line for less than 48 (forty-eight) hours. During these startup periods, all reasonable efforts shall be made to minimise the number and magnitude of the exceedances.

    (b) During boiler shutdowns, an exemption from the 40% opacity limit is allowed for up to 5 (five) six minute average periods, with none of the averages to exceed 80%.

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

105 South Meridian Street
P.O. Box 6015
Indianapolis 46206-6015
Telephone 317/232-8603

January 18, 1990

TO: All NPDES PERMIT Applicants

FROM: Charles B. Bardonner
Assistant Commissioner
Office of Water Management

SUBJECT: Request for Information

We request that you fill in the blanks on this form and return it along with your NPDES PERMIT application. The information provided will be helpful in our personal contacts with officials of your municipality, industry or other facility in assuring prompt delivery of correspondence, etc. Thank you for your cooperation.

I. *Current NPDES Permit No.*____________*(New applicant will be assigned a number later)*

II. WASTEWATER TREATMENT FACILITY LOCATION ADDRESS

Facility Name: Richmond Power & Light
Address: 2000 U.S. 27 South
City: Richmond State: IN Zip: 47374
Telephone: (317) 973-7200

III. *DISCHARGE MONITORING REPORT (DMR) MAILING ADDRESS (ADDRESS WHERE IDEM IS TO SEND PRE-PRINTED DMRS)*

Name: Robert A. Hart Title: Safety and Enviornmental Director
Address: 2000 U.S. 27 South
City: Richmond State: IN Zip: 47374
Telephone: (317) 973-7200
Cognizant Official (Representative responsible for completing DMR):
____________ Title: ____________

IV. OWNER ADDRESS

Owner Name: Richmond Power & Light Title: ____________
Address: 2000 U.S. 27 South
City: Richmond State: IN Zip: 47374
Telephone: (317) 973-7200

V. WASTEWATER TREATMENT PLANT OPERATOR/SUPERINTENDENT ADDRESS

Operator Name: Dale Norris Certificate No. ____________
Address: 2000 U.S. 27 South
City: Richmond State: IN Zip: 47374
Telephone: Work: (317) 973-7200 Home: (317) 962-6475

FORM 1 GENERAL

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

F IND072050461 D

LABEL ITEMS

I. EPA I.D. NUMBER

III. FACILITY NAME

V. FACILITY MAILING ADDRESS

VI. FACILITY LOCATION

PLEASE PLACE LABEL IN THIS SPACE

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill-in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold-faced terms.

SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED
A. Is this facility a publicly owned treatment works which results in a discharge to waters of the U.S.? (FORM 2A)		X		B. Does or will this facility *(either existing or proposed)* include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to waters of the U.S.? (FORM 2B)		X	
C. Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)	X			D. Is this a proposed facility *(other than those described in A or B above)* which will result in a discharge to waters of the U.S.? (FORM 2D)		X	
E. Does or will this facility treat, store, or dispose of hazardous wastes? (FORM 3)		X		F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
I. Is this facility a proposed stationary source which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X		J. Is this facility a proposed stationary source which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	

III. NAME OF FACILITY

1 SKIP RICHMOND POWER AND LIGHT

IV. FACILITY CONTACT

A. NAME & TITLE *(last, first, & title)*	B. PHONE *(area code & no.)*
HART, ROBERT SAFETY AND ENVIRONMENTAL DIRECTOR	317 973 7200

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX

2000 U.S. 27 SOUTH

B. CITY OR TOWN	C. STATE	D. ZIP CODE
RICHMOND	IN	47374

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER

RICHMOND POWER & LIGHT, 2000 U.S. 27 SOUTH

B. COUNTY NAME

WAYNE

C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE *(if known)*
RICHMOND	IN	47374	

CONTINUED FROM THE FRONT

VII. SIC CODES (4-digit, in order of priority)

A. FIRST	B. SECOND
7 4911 (specify) Electric Services	7 (specify)
C. THIRD	D. FOURTH
7 (specify)	7 (specify)

VIII. OPERATOR INFORMATION

A. NAME

8 RICHMOND POWER & LIGHT

B. Is the name listed in Item VIII-A also the owner? [X] YES [ ] NO

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)

F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC (other than federal or state)
O = OTHER (specify)

M (specify) City Owned

D. PHONE (area code & no.)

A 317 973 7200

E. STREET OR P.O. BOX

2000 US 27 South

F. CITY OR TOWN	G. STATE	H. ZIP CODE
B RICHMOND	IN	47374

IX. INDIAN LAND

Is the facility located on Indian lands?

[ ] YES [X] NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water)	D. PSD (Air Emissions from Proposed Sources)
9 N	9 P
B. UIC (Underground Injection of Fluids)	E. OTHER (specify)
9 U	9 (specify)
C. RCRA (Hazardous Wastes)	E. OTHER (specify)
9 R IND 072050461	9 (specify)

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property bounderies. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS (provide a brief description)

Generation and transmission of electricity

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)	B. SIGNATURE	C. DATE SIGNED
Robert A. Hart Safety and Environmental Director	[signature]	April 17,1990

COMMENTS FOR OFFICIAL USE ONLY

C

CONTINUED FROM PAGE 2

EPA I.D. NUMBER (copy from Item 1 of Form 1)
IND072050461

Form Approved.
OMB No. 2040-0086
Approval expires 7-31-88

V. INTAKE AND EFFLUENT CHARACTERISTICS

A, B, & C: See instructions before proceeding – Complete one set of tables for each outfall – Annotate the outfall number in the space provided.
NOTE: Tables V-A, V-B, and V-C are included on separate sheets numbered V-1 through V-9.

D. Use the space below to list any of the pollutants listed in Table 2c-3 of the instructions, which you know or have reason to believe is discharged or may be discharged from any outfall. For every pollutant you list, briefly describe the reasons you believe it to be present and report any analytical data in your possession.

1. POLLUTANT	2. SOURCE	1. POLLUTANT	2. SOURCE
	N/A		

VI. POTENTIAL DISCHARGES NOT COVERED BY ANALYSIS

Is any pollutant listed in Item V-C a substance or a component of a substance which you currently use or manufacture as an intermediate or final product or byproduct?

☐ YES (list all such pollutants below) ☒ NO (go to Item VI-B)

CONTINUED FROM THE FRONT

VII. BIOLOGICAL TOXICITY TESTING DATA

Do you have any knowledge or reason to believe that any biological test for acute or chronic toxicity has been made on any of your discharges or on a receiving water in relation to your discharge within the last 3 years?

☐ YES (identify the test(s) and describe their purposes below) XX NO (go to Section VIII)

VIII CONTRACT ANALYSIS INFORMATION

Were any of the analyses reported in Item V performed by a contract laboratory or consulting firm?

XX YES (list the name, address, and telephone number of, and pollutants analyzed by, each such laboratory or firm below) ☐ NO (go to Section IX)

A. NAME	B. ADDRESS	C. TELEPHONE (area code & no.)	D. POLLUTANTS ANALYZED
			ALL
ESG. INC.	520 Virginia Ave. Indianapolis, IN 46206	(317) 635-1123	

IX. CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. NAME & OFFICIAL TITLE (type or print)	B. PHONE NO. (area code & no.)
Robert A. Hart Safety and Environmental Director	(317) 973-7200
C. SIGNATURE	D. DATE SIGNED
Robt A Hart	4-17-90

Please print or type in the unshaded areas only. IND072050461

OMB No. 2040-0086
Approval expires 7-31-88

FORM 2C NPDES

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER
EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURAL OPERATIONS
Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER *(list)*	B. LATITUDE 1. DEG.	2. MIN.	3. SEC.	C. LONGITUDE 1. DEG.	2. MIN.	3. SEC.	D. RECEIVING WATER *(name)*
001	39	48	09	084	53	43	Storm Sewer to Dubners Ditch

II. FLOWS, SOURCES OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined *(e.g., for certain mining activities)*, provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUTFALL NO *(list)*	2. OPERATION(S) CONTRIBUTING FLOW a. OPERATION *(list)*	b. AVERAGE FLOW *(include units)*	3. TREATMENT a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	
		750,000 GPD	1 Large Pond	1-U	
			3 Aux Ponds	1-U	
			See Attached Drawing of Ponds		

OFFICIAL USE ONLY *(effluent guidelines sub-categories)*

CONTINUED FROM THE FRONT

C. Except for storm runoff, leaks, or spills, are any of the discharges described in Items II-A or B intermittent or seasonal?

☐ YES *(complete the following table)* XX NO *(go to Section III)*

1. OUTFALL NUMBER *(list)*	2. OPERATION(s) CONTRIBUTING FLOW *(list)*	3. FREQUENCY		4. FLOW				
		a. DAYS PER WEEK *(specify average)*	b. MONTHS PER YEAR *(specify average)*	a. FLOW RATE *(in mgd)*		b. TOTAL VOLUME *(specify with units)*		c. DURATION *(in days)*
				1. LONG TERM AVERAGE	2. MAXIMUM DAILY	1. LONG TERM AVERAGE	2. MAXIMUM DAILY	
	N/A							

III. PRODUCTION

A. Does an effluent guideline limitation promulgated by EPA under Section 304 of the Clean Water Act apply to your facility?

XX YES *(complete Item III-B)* ☐ NO *(go to Section IV)*

B. Are the limitations in the applicable effluent guideline expressed in terms of production *(or other measure of operation)*?

☐ YES *(complete Item III-C)* X NO *(go to Section IV)*

C. If you answered "yes" to Item III-B, list the quantity which represents an actual measurement of your level of production, expressed in the terms and units used in the applicable effluent guideline, and indicate the affected outfalls

1. AVERAGE DAILY PRODUCTION			2. AFFECTED OUTFALLS *(list outfall numbers)*
a. QUANTITY PER DAY	b. UNITS OF MEASURE	c. OPERATION, PRODUCT, MATERIAL, ETC. *(specify)*	
		N/A	

IV. IMPROVEMENTS

A. Are [illegible] Federal, State [illegible] authority [illegible] implementation schedule for the [illegible] water treatment equipment [illegible] practices or any other environmental programs [illegible] may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions

XX YES *(complete the following table)* ☐ NO *(go to Item IV-B)*

1. IDENTIFICATION OF CONDITION, AGREEMENT, ETC.	2. AFFECTED OUTFALLS		3. BRIEF DESCRIPTION OF PROJECT	4. FINAL COMPLIANCE DATE	
	a. NO.	b. SOURCE OF DISCHARGE		a. REQUIRED	b. PROJECTED
See Attached Page					

B. OPTIONAL: You may attach additional sheets describing any additional water pollution control programs *(or other environmental projects which may affect your discharges)* you now have underway or which you plan. Indicate whether each program is now underway or planned, and indicate your actual or planned schedules for construction. ☐ [illegible]

ƎASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of is information on separate sheets *(use the same format)* instead of completing these pages. ΞE INSTRUCTIONS.

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*
IND072050461

Form Approved
OMB No. 2040 0086
Approval expires 7 31 88

V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)*

OUTFALL NO
001

ƎART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
Biochemical Oxygen Demand (BOD)	6.9						1	mg/1				
Chemical Oxygen Demand (COD)	19.1						1	mg/1				
Total Organic Carbon *(TOC)*	40						1	mg/1				
Total Suspended Solids *(TSS)*	31.3				24.6		2	mg/1				
Ammonia *(as N)*	2.6						1	mg/1				
Flow	VALUE 750,000(est)		VALUE		VALUE			gpd		VALUE		
Temperature *(winter)*	VALUE		VALUE		VALUE			°C		VALUE		
Temperature *(summer)*	VALUE 13		VALUE		VALUE		1	°C		VALUE		
pH	MINIMUM 6.5	MAXIMUM	MINIMUM	MAXIMUM			1	STANDARD UNITS				

ƎART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'		3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
Bromide (24959-67-9)		X												
Chlorine, Total Residual			< 0.5						1	mg/1				
Color		X												
Fecal Coliform		X												
Fluoride (16984-48-8)		X												
Nitrate-Nitrite *(as N)*														

M ... CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. (if available)	2. MARK 'X' a. believed present	2. MARK 'X' b. believed absent	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) concentration	3. EFFLUENT a. MAXIMUM DAILY VALUE (2) mass	b. MAXIMUM 30 DAY VALUE (if available) (1) concentration	b. MAXIMUM 30 DAY VALUE (2) mass	c. LONG TERM AVRG. VALUE (if available) (1) concentration	c. LONG TERM AVRG. VALUE (2) mass	d. NO. OF ANALYSES	4. UNITS a. CONCENTRATION	4. UNITS b. MASS	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (1) concentration	5. INTAKE a. LONG TERM AVERAGE VALUE (2) mass	5. INTAKE b. NO. OF ANALYSES
trogen, l Organic)														
l and se														
sphorus , Total 3-14-0)			0.18						1	mg/1				
dioactivity														
lpha,		X												
ete,		X												
adium,		X												
adium Total		X												
lfate $)_4)$ 8-79-8)														
fide			0.1						1	mg/1				
lfite $)_3)$ 5-45-3)														
factants		X												
minum, -90-5)			6.25						1	mg/1				
ium, -39-3)		X												
on, -42-8)			0.532						1	mg/1				
alt, -48-4)		X												
, Total -89-6)			4.51						1	mg/1				
nesium, 95-4)			39.2						1	mg/1				
ybdenum, -98-7)		X												
nganese, 96-5)			0.12						1	mg/1				
, Total -31-5)		X												
anium, -32-6)		X												

CONTINUE ON PAGE V-3

EPA I.D. NUMBER (copy from Item 1 of Form 1)	OUTFALL NUMBER
IND072050461	001

Form Approved
OMB No. 2040-0086
Approval expires 7-31-88

CONTINUED FROM PAGE 3 OF FORM 2-C

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (*secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions*), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table *(all 7 pages)* for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK "X" a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	(2) MASS	b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	(2) MASS	c. LONG TERM AVRG. VALUE (if available) (1) CONCENTRATION	(2) MASS	d. NO. OF ANALYSES	4. UNITS a. CONCENTRATION	b. MASS	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	(2) MASS	b. NO. OF ANALYSES
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)			X												
2M. Arsenic, Total (7440-38-2)			X												
3M. Beryllium, Total, 7440-41-7)				<0.01						1	mg/1				
4M. Cadmium, Total (7440-43-9)				<0.005						1	mg/1				
5M. Chromium, Total (7440-47-3)				0.04						1	mg/1				
6M. Copper, Total (7440-50-8)				0.14						1	mg/1				
7M. Lead, Total (7439-92-1)				0.60						1	mg/1				
8M. Mercury, Total (7439-97-6)				<0.002						1	mg/1				
9M. Nickel, Total (7440-02-0)				<0.01						1	mg/1				
10M. Selenium, Total (7782-49-2)			X												
11M. Silver, Total (7440-22-4)				<0.01						1	mg/1				
12M. Thallium, Total (7440-28-0)			X												
13M. Zinc, Total (7440-66-6)				0.64						1	mg/1				
14M. Cyanide, Total (57-12-5)				<0.005						1	mg/1				
15M. Phenols, Total			X												
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P-Dioxin (1764-01-6)			X	DESCRIBE RESULTS											

CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (optional)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION — VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)			X												
2V. Acrylonitrile (107-13-1)			X												
3V. Benzene (71-43-2)				ND						1	ppb				
4V. Bis (Chloromethyl) Ether (542-88-1)				ND						1	ppb				
5V. Bromoform (75-25-2)			X												
6V. Carbon Tetrachloride (56-23-5)				ND						1	ppb				
7V. Chlorobenzene (108-90-7)				ND						1	ppb				
8V. Chlorodibromomethane (124-48-1)				ND						1	ppb				
9V. Chloroethane (75-00-3)				ND						1	ppb				
10V. 2-Chloroethylvinyl Ether (110-75-8)				ND						1	ppb				
11V. Chloroform (67-66-3)				ND						1	ppb				
12V. Dichlorobromomethane (75-27-4)				ND						1	ppb				
13V. Dichlorodifluoromethane (75-71-8)			X												
14V. 1,1-Dichloroethane (75-34-3)			X												
15V. 1,2-Dichloroethane (107-06-2)				ND						1	ppb				
16V. 1,1-Dichloroethylene (75-35-4)				ND						1	pppb				
17V. 1,2-Dichloropropane (78-87-5)				ND						1	ppb				
18V 1,3-Dichloropropylene (542-75-6)			X												
19V. Ethylbenzene (100-41-4)				ND						1	ppb				
20V. Methyl Bromide (74-83-9)				ND						1	ppb				
21V. Methyl Chloride (74-87-3)				ND						1	ppb				

CONTINUE ON PAGE V

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X' a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	(2) MASS	b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	(2) MASS	c. LONG TERM AVRG. VALUE (if available) (1) CONCENTRATION	(2) MASS	d. NO. OF ANALYSES	4. UNITS a. CONCENTRATION	b. MASS	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	(2) MASS	b. NO. ANALYSES
GC/MS FRACTION – VOLATILE COMPOUNDS (continued)															
22V. Methylene Chloride (75-09-2)				ND						1	ppb				
23V. 1,1,2,2-Tetrachloroethane (79-34-5)				ND						1	ppb				
24V. Tetrachloroethylene (127-18-4)				ND						1	ppb				
25V. Toluene (108-88-3)				ND						1	ppb				
26V. 1,2-Trans-Dichloroethylene (156-60-5)				ND						1	ppb				
27V. 1,1,1-Trichloroethane (71-55-6)				ND						1	ppb				
28V. 1,1,2-Trichloroethane (79-00-5)				ND						1	ppb				
29V. Trichloroethylene (79-01-6)				ND						1	ppb				
30V. Trichlorofluoromethane (75-69-4)			X												
31V. Vinyl Chloride (75-01-4)				ND						1	ppb				
GC/MS FRACTION – ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)				ND						1	ppb				
2A. 2,4-Dichlorophenol (120-83-2)				ND						1	ppb				
3A. 2,4-Dimethylphenol (105-67-9)				ND						1	ppb				
4A. 4,6-Dinitro-O-Cresol (534-52-1)				ND						1	ppb				
5A. 2,4-Dinitrophenol (51-28-5)				ND						1	ppb				
6A. 2-Nitrophenol (88-75-5)				ND						1	ppb				
7A. 4-Nitrophenol (100-02-7)				ND						1	ppb				
8A. P-Chloro-M-Cresol (59-50-7)				ND						1	ppb				
9A. Pentachlorophenol (87-86-5)				ND						1	ppb				
10A. Phenol (108-95-2)				ND						1	ppb				
11A. 2,4,6-Trichlorophenol (88-06-2)				ND						1	ppb				

. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (optional)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
C/MS FRACTION — BASE/NEUTRAL COMPOUNDS															
B. Acenaphthene 33-32-9)				ND						1	ppb				
B. Acenaphtylene 208-96-8)				ND						1	ppb				
B. Anthracene 120-12-7)				ND						1	ppb				
B. Benzidine 12-87-5)			X												
B. Benzo (a) nthracene 56-55-3)			X												
B. Benzo (a) yrene (50-32-8)				ND						1	ppb				
B. 3,4-Benzo-uoranthene 205-99-2)				ND						1	ppb				
B. Benzo (ghi) erylene 91-24-2)				ND						1	ppb				
B. Benzo (k) uoranthene 207-08-9)				ND						1	ppb				
B. Bis (2-Chloro-thoxy) Methane 111-91-1)				ND						1	ppb				
B. Bis (2-Chloro-thyl) Ether 111-44-4)				ND						1	ppb				
B. Bis (2-Chloroiso-pyl) Ether (102-80-1)			X												
B. Bis (2-Ethyl-xyl) Phthalate 117-81-7)				ND						1	ppb				
B. 4-Bromo-enyl Phenyl her (101-55-3)				ND						1	ppb				
B. Butyl Benzyl thalate (85-68-7)				ND						1	ppb				
B. 2-Chloro-phthalene 1-58-7)				ND						1	ppb				
B. 4-Chloro-enyl Phenyl her (7005-72-3)				ND						1	ppb				
B. Chrysene 18-01-9)				ND						1	ppb				
B. Dibenzo (a,h) nthracene 3-70-3)				ND						1	ppb				
B. 1,2-Dichloro-nzene (95-50-1)				ND						1	ppb				
B. 1,3-Dichloro-nzene (541-73-1)				ND						1	ppb				

CONTINUE ON PAGE V-

OLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (optional)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
MS FRACTION – BASE/NEUTRAL COMPOUNDS (continued)															
1,4-Dichloro-ene (106-46-7)				ND						1	ppb				
3,3'-Dichloro-idine 94-1)				ND						1	ppb				
Diethyl alate 56-2)				ND						1	ppb				
Dimethyl alate -11-3)				ND						1	ppb				
Di-N-Butyl alate 74-2)				ND						1	ppb				
2,4-Dinitro-ne (121-14-2)				ND						1	ppb				
2,6-Dinitro-ne (606-20-2)				ND						1	ppb				
Di-N-Octyl alate 84-0)				ND						1	ppb				
1,2-Diphenyl-zine (as Azo-ne) (122-66-7)			X												
Fluoranthene 44-0)				ND						1	ppb				
Fluorene 3-7)				ND						1	ppb				
xachlorobenzene 1-1)				ND						1	ppb				
Hexa-obutadiene 8-3)				ND						1	ppb				
Hexachloro-pentadiene 7-4)				ND						1	ppb				
Hexachloro-e (67-72-1)				ND						1	ppb				
Indeno (-cd) Pyrene 39-5)				ND						1	ppb				
Isophorone 9-1)				ND						1	ppb				
Naphthalene 0-3)				ND						1	ppb				
Nitrobenzene 5-3)				ND						1	ppb				
N-Nitro-ethylamine 5-9)			X												
N-Nitrosodi-pylamine 54-7)				ND						1	ppb				

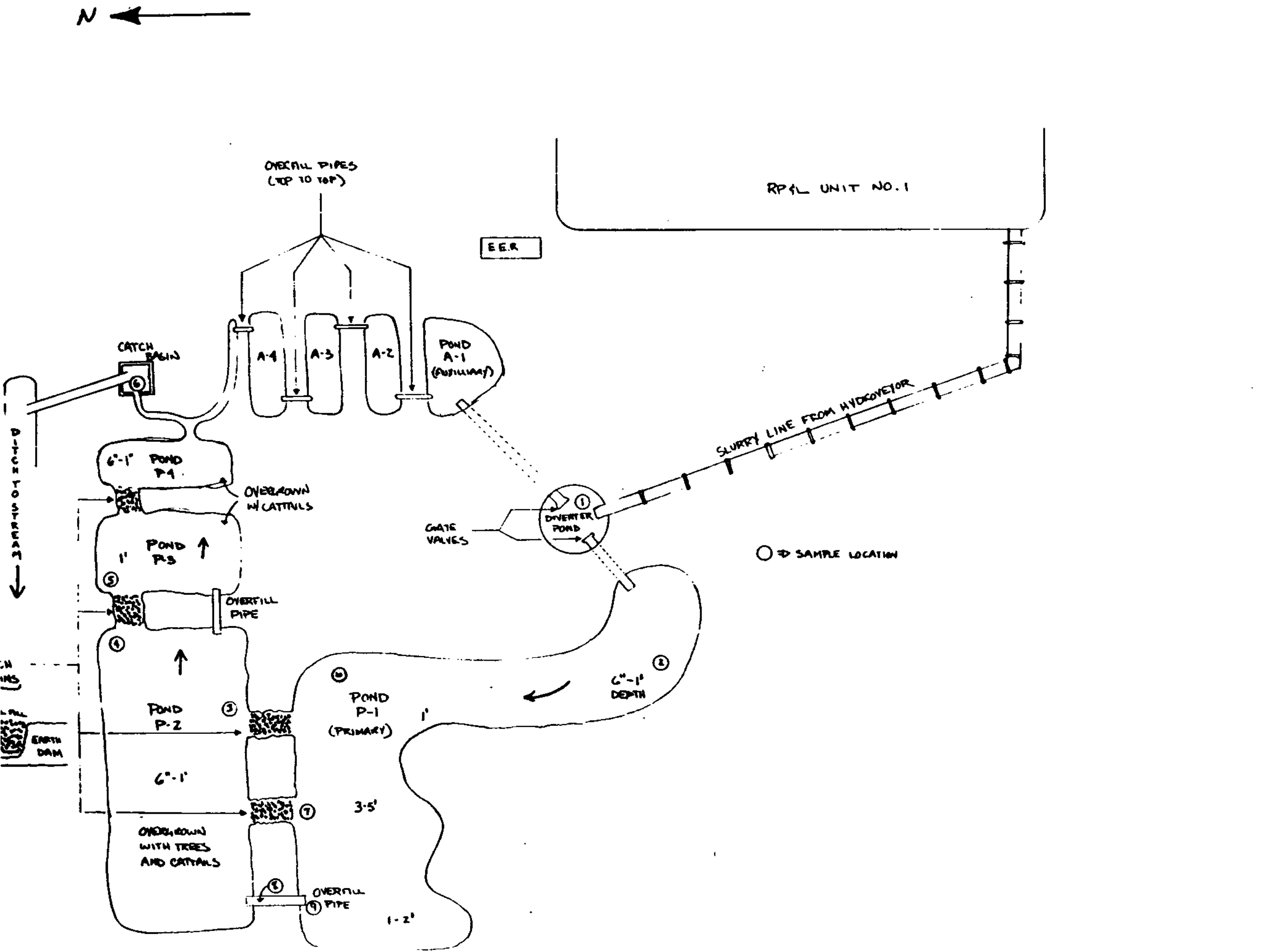
CONTINUE ON REVERSE

TINUED FROM THE FRONT

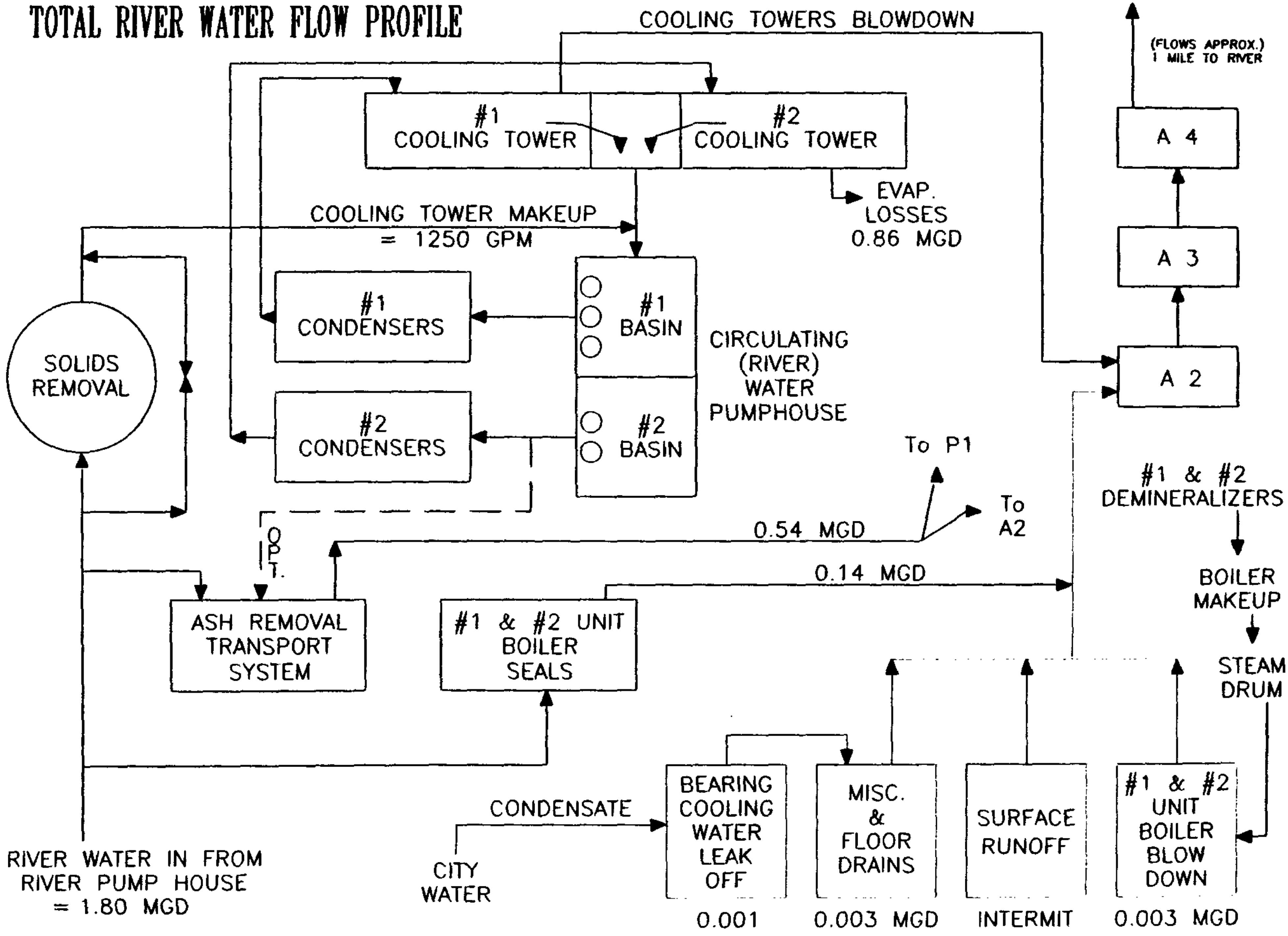
OLLUTANT AND CAS NUMBER (if available)	2. MARK "X" a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	(2) MASS	b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	(2) MASS	c. LONG TERM AVRG. VALUE (if available) (1) CONCENTRATION	(2) MASS	d. NO. OF ANALYSES	4. UNITS a. CONCENTRATION	b. MASS	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	(2) MASS	b. NO. OF ANALYSES
IS FRACTION – BASE/NEUTRAL COMPOUNDS (continued)															
N-Nitro-henylamine 0-6)			X												
Phenanthrene 1-8)			X												
Pyrene 00-0)				ND						1	ppb				
1,2,4 - Tri-obenzene 82-1)				ND						1	ppb				
IS FRACTION – PESTICIDES															
ldrin 00-2)				ND						1	ppb				
-BHC 84-6)				ND						1	ppb				
-BHC 85-7)				ND						1	ppb				
-BHC 9-9)			X												
-BHC 86-8)				ND						1	ppb				
hlordane 4-9)				ND						1	ppb				
4'-DDT 9-3)				ND						1	ppb				
4'-DDE 5-9)				ND						1	ppb				
4'-DDD 4-8)				ND						1	ppb				
Dieldrin 7-1)				ND						1	ppb				
l-Endosulfan 29-7)			X												
-Endosulfan 29-7)			X												
ndosulfan e -07-8)				ND						1	ppb				
ndrin -8)				ND						1	ppb				
ndrin yde 93-4)				ND						1	ppb				
leptachlor -8)				ND						1	ppb				

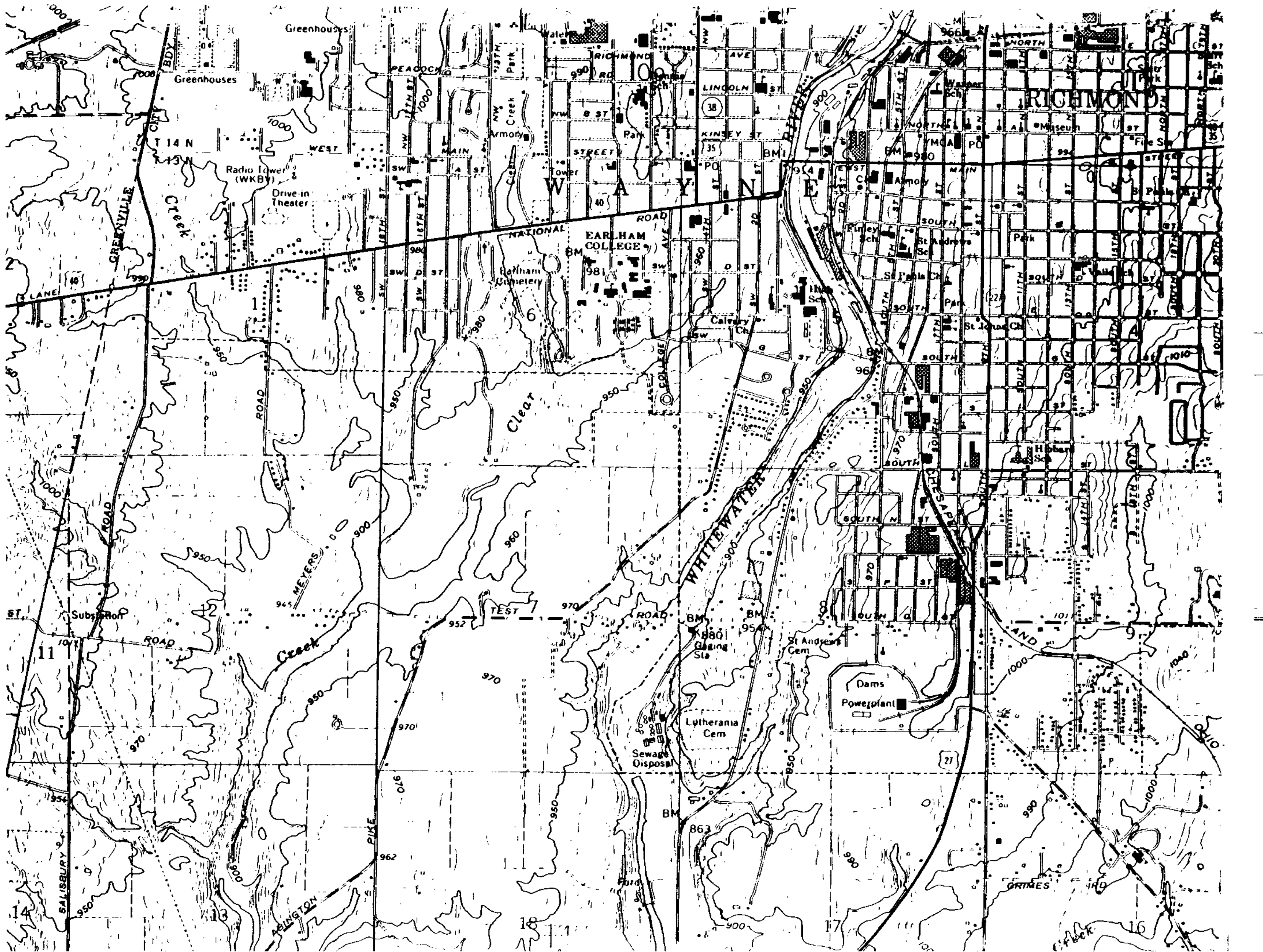
CONTINUE ON PAGE V-9

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X' a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	(2) MASS	b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	(2) MASS	c. LONG TERM AVRG. VALUE (if available) (1) CONCENTRATION	(2) MASS	d. NO. OF ANALYSES	4. UNITS a. CONCENTRATION	b. MASS	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	(2) MASS	b. NO. OF ANALYSES
C/MS FRACTION — PESTICIDES (continued)															
7P. Heptachlor poxide 024-57-3)				ND						1	ppb				
3P. PCB-1242 3469-21-9)				ND						1	ppb				
9P. PCB-1254 1097-69-1)				ND						1	ppb				
0P. PCB-1221 1104-28-2)				ND						1	ppb				
1P. PCB-1232 1141-16-5)				ND						1	ppb				
2P. PCB-1248 2672-29-6)				ND						1	ppb				
3P. PCB-1260 1096-82-5)				ND						1	ppb				
4P. PCB-1016 2674-11-2)				ND						1	ppb				
5P. Toxaphene 001-35-2)				ND						1	ppb				


N
OVERFILL PIPES
(TOP TO TOP)
RP&L UNIT NO. 1
E.E.R.
CATCH BASIN
A-4
A-3
A-2
POND
A-1
(AUXILIARY)
SLURRY LINE FROM HYDROVEYOR
DITCH TO STREAM
6"-1'
POND
P-4
OVERGROWN
W/ CATTAILS
GATE
VALVES
DIVERTER
POND
O = SAMPLE LOCATION
POND
P-3
1'
OVERFILL
PIPE
6"-1'
DEPTH
POND
P-1
(PRIMARY)
1'
POND
P-2
EARTH
DAM
6"-1'
3-5'
OVERGROWN
WITH TREES
AND CATTAILS
OVERFILL
PIPE
1-2'

RICHMOND POWER & LIGHT
TOTAL RIVER WATER FLOW PROFILE




RICHMOND
WAYNE
EARLHAM COLLEGE
Earlham Cemetery
WHITEWATER
RIVER
Clear
Creek
NATIONAL ROAD
GREENVILLE
CITY BDY
T 14 N
T 13 N
Greenhouses
Radio Tower (WKBV)
Drive-in Theater
Armory
Museum
YMCA
PO
Fire Sta
St Andrews Sch
St Pauls Ch
St Johns Ch
Calvary Ch
Hibbard Sch
Finley Sch
Wagner Sch
Gaging Sta
St Andrews Cem
Lutherania Cem
Sewage Disposal
Dams
Powerplant
Substation
MEYERS
TEST ROAD
PIKE
SALISBURY
GRIMES
CHESAPEAKE AND OHIO
PEACOCK
LINCOLN ST
KINSEY ST
MAIN ST
SOUTH
NORTH
WEST
Ford

APPENDIX D
STATEMENT OF WORK

STATEMENT OF WORK FOR LIFAC DEMONSTRATION AT RICHMOND POWER AND LIGHT WHITEWATER VALLEY UNIT NO. 2

OVERVIEW

The project will entail a full-scale commercial demonstration of LIFAC conducted under the U.S. Department of Energy (DOE) Clean Coal Technology III Program. LIFAC refers to Limestone Injection into the Furnace with calcium oxide ACtivation. The technology contains an unusual combination of features contained in other sorbent injection approaches, including injection of a calcium material into the upper furnace and in-duct humidification after the air preheater (Figure 1). The LIFAC process also contains a unique patented feature known as the activation chamber which is a vertical elongation of the ductwork between the air preheater and ESP and other unique process and equipment features. In recognition of this unique approach, the LIFAC technology has been patented in the U.S., receiving approval in July, 1988 of a November, 1985 application.

The site selected for the LIFAC demonstration is Whitewater Valley Unit No. 2, a 60 MWe coal-fired powerplant owned and operated by Richmond Power and Light (RP&L) and located in Richmond, Indiana. Whitewater Valley was selected as the LIFAC test site because:

- The plant consumes high sulfur Indiana coals with sulfur contents ranging between 2.0 and 3.5 percent. Previous LIFAC tests have all been conducted on lower sulfur content coals.
- The site is considered a difficult retrofit installation due to its cramped design and high operating temperatures. A success here will demonstrate LIFAC's broad applicability to the large number of U.S. powerplants likely to have to reduce emissions under future acid rain regulations.
- The tangentially-fired boiler is small for its capacity, increasing flue gas flow rates in the boiler and reducing particle residence time. This complicates the demonstration, but success under these conditions will reinforce its broad applicability and improve its marketability.
- The plant is a baseload facility operating between a 70 and 80 percent utilization level at over 90 percent availability. These levels are higher than other LIFAC installations; therefore, the opportunity exists to demonstrate that LIFAC is compatible with reliable U.S. baseload powerplant operations.

Even under the above conditions, LIFAC is expected to remove 75 to 80 percent of flue gas sulfur dioxide at calcium to sulfur molar ratios of 2.0 to 2.5. Thus, a successful demonstration will provide U.S. industry an economic emission control technology with removal capabilities in between those of expensive conventional scrubbers and furnace sorbent injection.

To demonstrate the technical viability of the LIFAC process to economically reduce sulfur emissions from the Whitewater Valley Unit No. 2, LIFAC North America will conduct a three-phase project.

Phase I: Design
Phase IIA: Long Lead Procurement
Phase IIB: Construction
Phase III: Operations

Figure 1 - LIFAC Demonstration Process Diagram

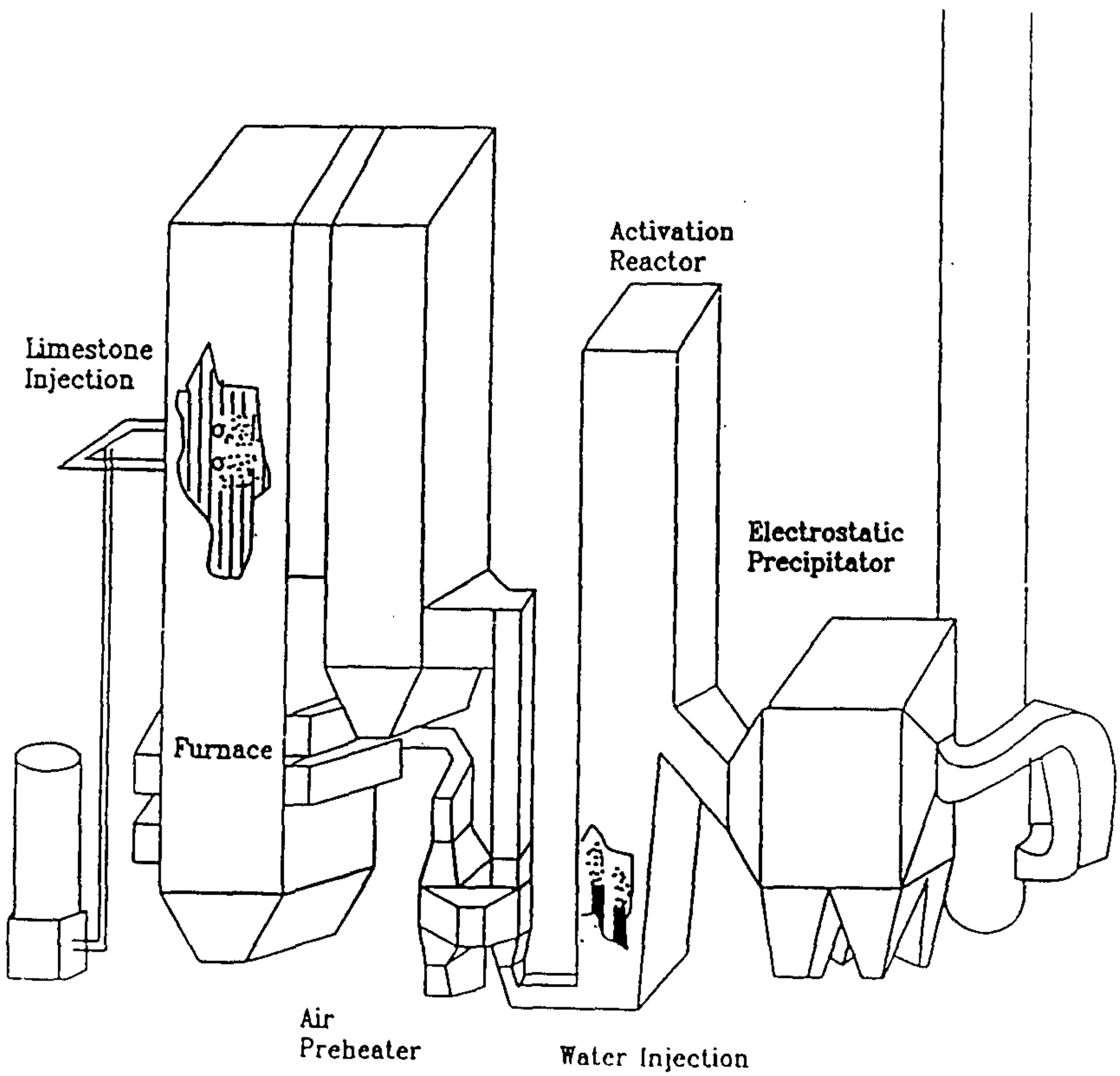
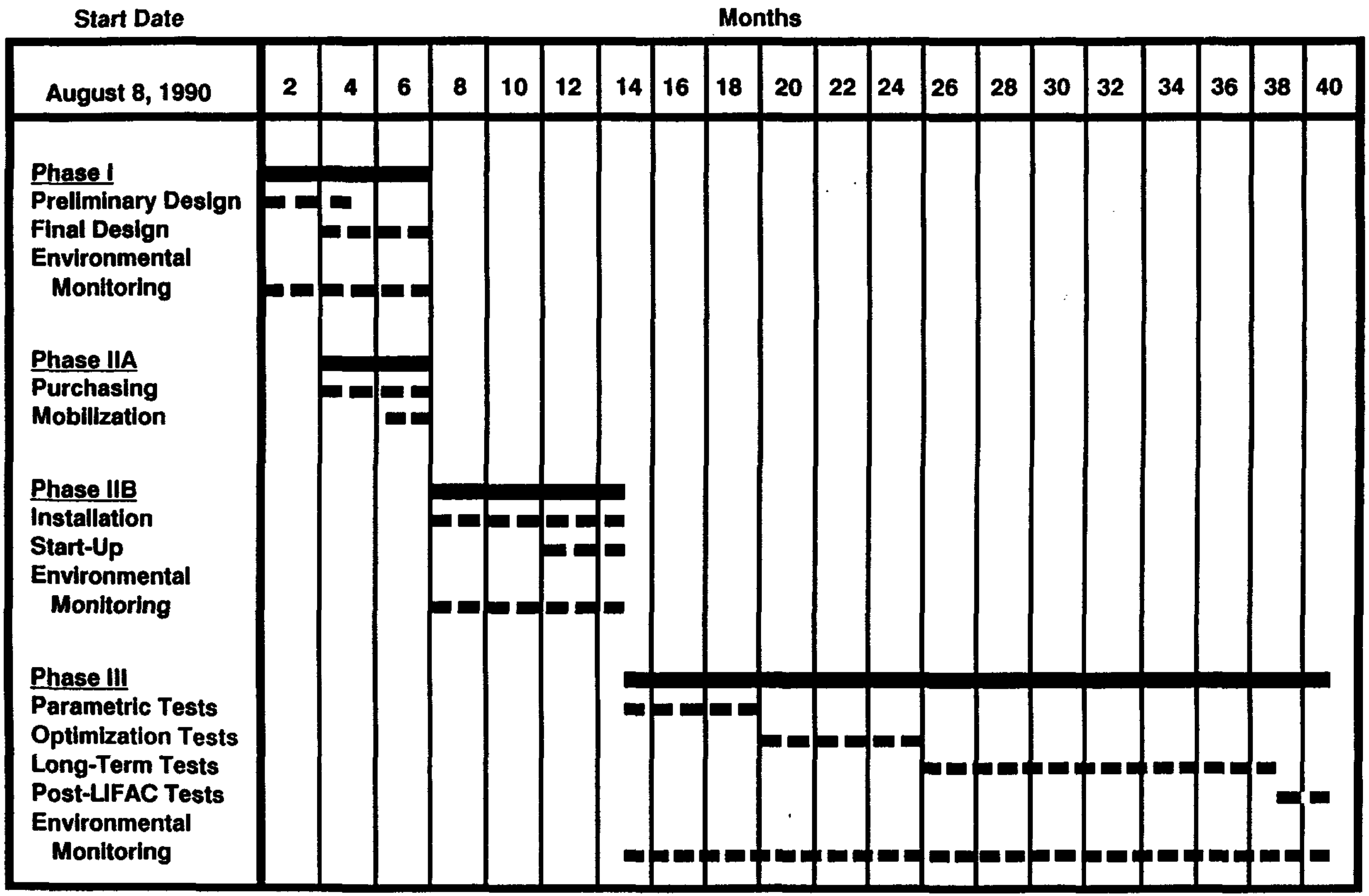


Figure 2 - LIFAC Demonstration Project Schedule



Except Phase IIA, each phase is comprised of three (3) tasks, a management and administration task, a technical task and an environmental task. The design phase will begin August 8, 1990 and will require six (6) months to complete. Phase IIA, long lead procurement, will overlap the design phase and will require about four (4) months to complete. The construction phase will then continue for another seven (7) months, while the operations phase is scheduled to last about twenty-six (26) months. Figure 2 shows the estimated project schedule which is based on a August 8, 1990 start date and a planned outage of Whitewater Valley Unit No. 2 during March 1991.

It is during this outage that all the tie-ins and modifications to existing Unit No. 2 equipment will be made. This will require that the construction phase begin in early February, 1991 -- construction and start-up will then be completed by the end of August 1991. Operations and testing will begin in September 1991 and will continue for 26 months

PROJECT TEAM

The LIFAC demonstration at Whitewater Valley Unit No. 2 will be conducted by LIFAC North America (LIFAC N.A.), a joint venture of two companies:

- ICF Kaiser Engineers - A U.S. company based in Oakland, California, and a subsidiary of American Capital and Research (ACR) based in Fairfax, Virginia.

- Tampella Limited - A large diversified international company based in Tampere, Finland and the original developer of the LIFAC technology.

LIFAC N.A. will be responsible for the overall administration of the project and for providing the 50 percent matching funds. Except for project administration, however, most of the actual work will be performed by the two parent firms under service agreements with LIFAC N.A. Both parent firms will work closely with Richmond Power and Light and the other project team members, including ICF Resources, the Electric Power Research Institute (EPRI), Indiana Corporation for Science and Technology (ICS&T), Peabody Coal Company, Black Beauty Coal Company, and LaFarge Corporation. LIFAC N.A. will have ICF Kaiser Engineers manage the demonstration project out of its Pittsburgh office, which will provide excellent access to the DOE representatives of the Pittsburgh Energy Technology Center. Figure 3 shows the management structure that will be used throughout the three phases of the project.

LIFAC N.A. will administer the project through a Management Committee composed of three (3) Tampella members and three (3) ICF Kaiser Engineers members that will decide the overall policies, budgets, and schedules. All funding sources, invoicing, and information will flow to LIFAC N.A. where the Program Manager will ensure that the project, funding and expenditures are consistent and in-line with the established policies, budgets, schedules and procedures.

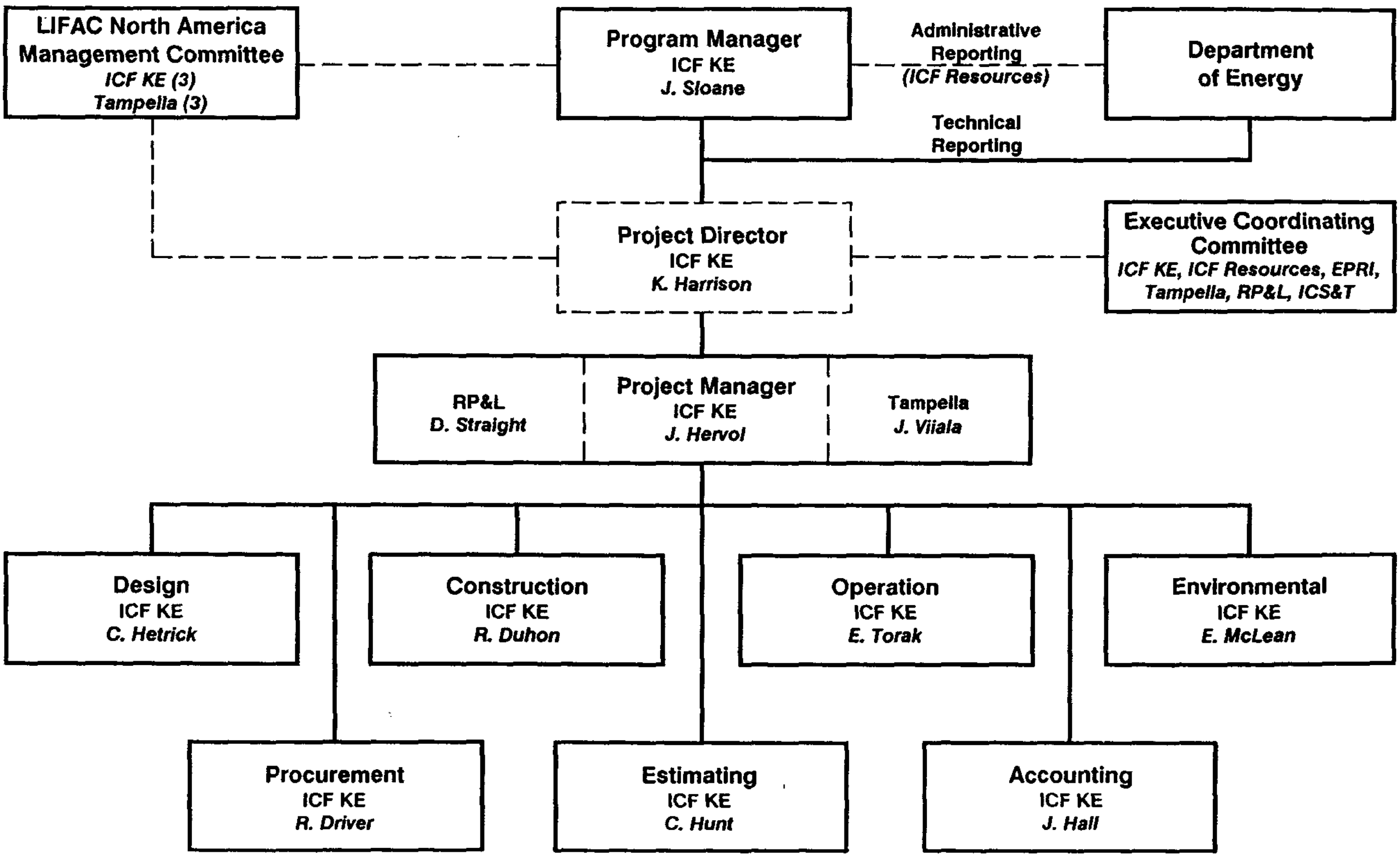
Specific task assignments consistent with the budgets, policies, and schedules established by the Management Committee will be written and agreed to in authorizing work and support from LIFAC N.A. and each of the major participants: Tampella, ICF Kaiser Engineers, ICF Resources, and RP&L. As these task assignments are initiated, periodic monthly Critical Items Reports (CIR's) will be submitted by each group/company authorized to perform work (and to be paid for that work). These CIR's provide the flow of information back to LIFAC N.A. and the Program Manager acting on behalf of the Management Committee to ensure that all work is being done on schedule and within the budgets established for the work.

This structure will (1) give DOE and all participants the assurances that there will be specific firm-by-firm accountability and overall control maintained by LIFAC N.A., and (2) allows the flexibility needed to make timely decisions and to not overly burden the demonstration project with layers of bureaucracy that does little to improve control, but threatens to delay, complicate, and increase the costs of the project.

The Management Committee will also provide overall direction and guidance to the Project Director, who will be responsible for communicating with the Executive Coordinating Committee made up of ICF Kaiser Engineers, Tampella, ICF Resources, EPRI, RP&L, and ICS&T. The role of this committee is to provide input into the planning tasks and to carry project results back to their respective organizations.

The Project Director will be assisted by the Project Manager, who will manage the technical activities of the project as well as coordinate between DOE, Tampella, RP&L, other team members, and within ICF Kaiser Engineers. The Project Manager will have reporting to him managers responsible for design, construction, operations, environmental monitoring, procurement, accounting and cost estimating. Each of these managers will in turn be assisted by staff from the other project participants.

Figure 3 - LIFAC Demonstration Project Organization



WORK BREAKDOWN STRUCTURE

The scope of work for the LIFAC demonstration is summarized in Figure 4 in a work breakdown structure. There are three phases to the project with Phase II consisting of two parts: Long Lead Procurement and Construction. As stated earlier, except for Phase IIA, Long Lead Procurement, each phase has a management task and an environmental monitoring task which represents on-going activities in these areas during the entire 39-month project. The remaining task in each phase represents the technical effort that will be conducted under each specific phase.

PHASE I - DESIGN (WBS 1.1)

The design phase of the LIFAC demonstration project will be directed by ICF Kaiser Engineers working in close coordination with Tampella and Richmond Power and Light. Tampella, the original developer of the LIFAC technology, will take the lead on process engineering design activities supplying necessary information to ICF Kaiser Engineers. ICF Kaiser Engineers will take the lead on the site and component engineering design and manage the overall design effort having responsibility for successful coordination and integration of the various design activities. Both organizations will work closely with Richmond Power and Light, the owner and operator of Whitewater Valley, a 60 megawatt coal-fired powerplant and site of the demonstration. The work breakdown structure for Phase I is detailed in Figure 5.

Task 1 - Project Management (WBS 1.1.1)

The management system discussed previously is already in place and will be utilized to complete the activities in this task. ICF Kaiser Engineers will have overall technical management responsibilities, ICF Resources will have administrative responsibilities, and they will both periodically report to and be under the control of LIFAC N.A. LIFAC N.A. will in turn report to DOE.

Subtask 1.1 - Administrative and Financial Reporting (WBS 1.1.1.1). ICF Resources will be responsible for administering the demonstration project. Each project team member will provide cost invoices with back-up receipts based on each organization's internal accounting system. ICF Resources, in coordination with LIFAC N.A. and consistent with DOE's accounting and control requirements, will oversee this process including documentation of expenditures and procurement procedures and results.

At the beginning of the project, ICF Resources will prepare the baseline Financial Assistance Reports and then LIFAC N.A. will submit them to DOE as required. These include:

- Federal Assistance Management Summary Report (Form EIA-459E)
- Federal Assistance Milestone Plan (Form EIA-459-53)
- Federal Assistance Budget Information Form (Form EIA-459C)

As actual cost information is obtained and progress reported, ICF Resources will update the Financial Assistance Reports and LIFAC N.A. will submit them to DOE as required.

Based on the detailed invoices provided by the team members, LIFAC N.A. will submit monthly invoices to DOE for payment. The invoices will reflect the total project cost during the period and cumulative cost-to-date. The invoices will also identify the cost-sharing portion and the funding source.

Subtask 1.2 - Technical Management and Integration (WBS 1.1.1.2). ICF Kaiser Engineers will be responsible for managing the project's start-up and design phase in addition to coordination between LIFAC N.A.,

Figure 4 - LIFAC Demonstration Work Breakdown Structure

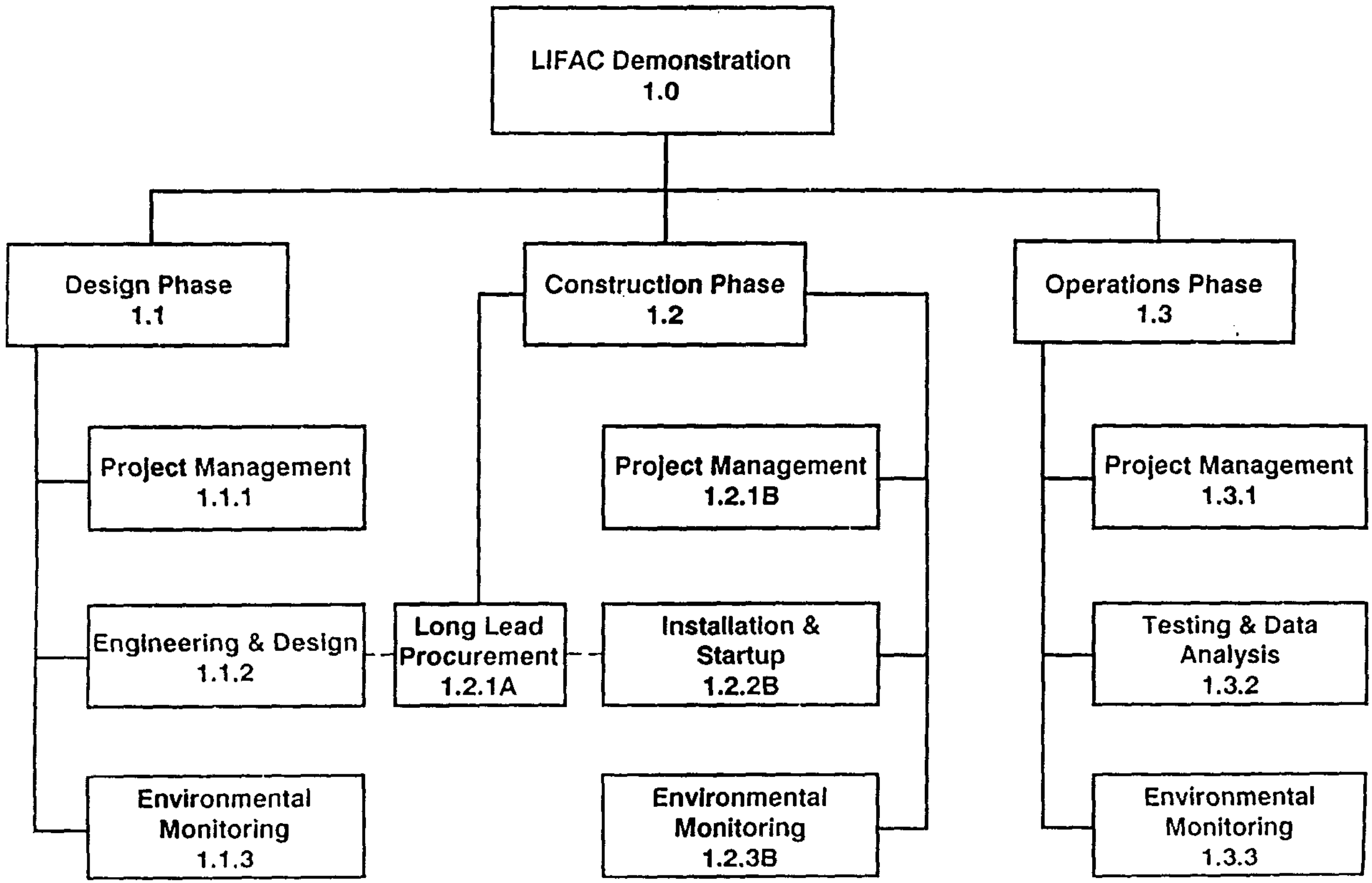
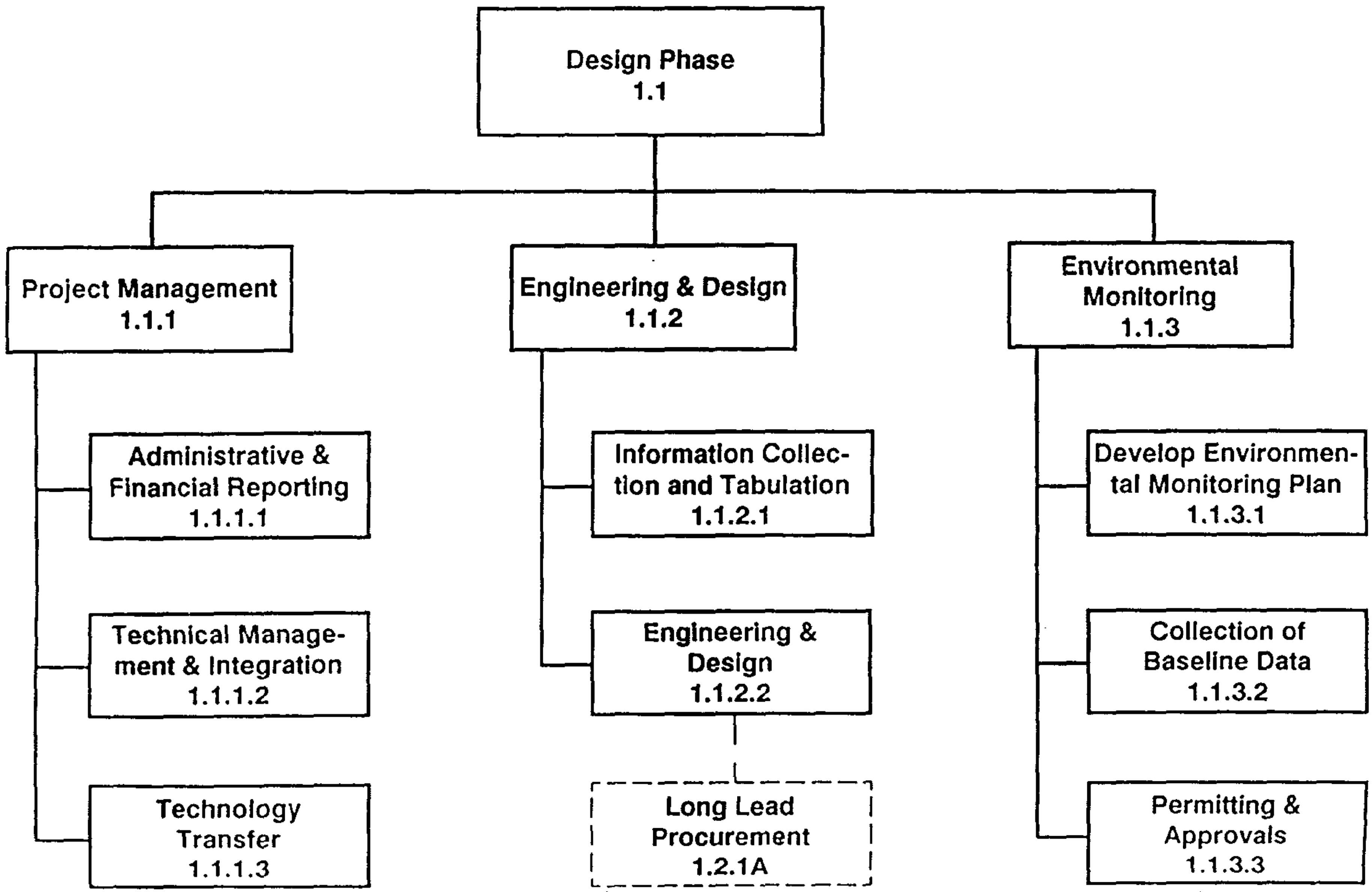


Figure 5 - LIFAC Demonstration Design Phase Structure



Tampella, RP&L, DOE and other project team members. Under this subtask, Tampella, RP&L and ICF Kaiser Engineers, will conduct start-up activities in cooperation with the project's overall LIFAC N.A. management team, including staff assignments, orientation and training of project personnel, and preliminary planning of the design tasks.

Specific activities that will be conducted under this subtask include:

- Development of the Project Evaluation Plan for Budget Period I. The plan will identify the accomplishments that will be achieved during the Design and Construction Phases and the criteria that can be used for evaluating the performance of the team. During Budget Period I, the Project Evaluation Plan will address the baseline cost and schedule, the project management plan, the technical objectives to achieve, the environmental requirements, test planning, and reporting needs.

- Three Technical Progress/Review Meetings, including an initial kickoff meeting to review the Project Evaluation Plan, a Preliminary Design review meeting and a final meeting to review and summarize the results of the Design Phase. At the final meeting, the team will review the Final Design Report and the Environmental Monitoring Plan.

- Development of the Project Management Plan, including:

    - A Work Breakdown Structure (WBS), at least to Level 4, identifying the major WBS elements.

    - A detailed Milestone Schedule identifying the WBS elements, the start and end dates of each element, the major milestones and delivery dates, and the reporting requirements.

    - A detailed Labor Distribution and Cost Plan broken down by WBS element. Details will be given by organization, labor category, and year.

    - A detailed narrative of each WBS element describing the team's approach to each major task and subtask, the relationship of the task to the rest of the project, the deliverables required, the expected results and findings, evaluation methods and criteria, management responsibility, schedule and budget, and potential problems and solutions.

    - A Critical Path Method (CPM) chart identifying all project activities including their start dates, duration, and end dates. The critical path will be determined so that all activities along the critical path can be monitored and controlled to stay on schedule.

The Project Management Plan will be revised, as required, throughout the duration of the project. Revisions will be submitted to DOE for review, comment, and approval.

Subtask 1.3 - Technology Transfer (WBS 1.1.1.3). A comprehensive technology transfer effort will be undertaken to keep the project sponsors, project participants, and industry informed of the project status and developments. Technical papers and presentations will be given at conferences and workshops sponsored by DOE, EPRI, and others. The LIFAC technology will also be exhibited at two major utility conferences during the Design Phase.

<u>Task 2 - Engineering and Design (WBS 1.1.2)</u>

This is the largest task in the Design Phase in terms of budget and manpower requirements, and it will be subdivided into two major subtasks.

<u>Subtask 2.1 - Information Collection and Tabulation (WBS 1.1.2.1)</u>. The engineering and design team will visit the RP&L site to review all available design information and observe operations. Drawings, equipment specifications, design calculations, operating data, and performance reports not already collected during the negotiation phase will be obtained and distributed to the appropriate team members. The Project Manager will disseminate all information on the existing RP&L Whitewater Valley Unit No. 2 to the other team members, so that the design effort can begin as soon as possible after contract signing.

<u>Subtask 2.2 - Engineering and Design (WBS 1.1.2.2)</u>. Engineering will be conducted in two phases. The first phase or <u>preliminary design phase</u> will culminate in a publicly available Preliminary Design Report and technical progress meeting. The second phase or <u>detailed design phase</u> will culminate in a Detailed Design Report which will include a revised cost estimate. During detailed design, the construction drawings and equipment and construction specifications will be produced. The work will include modifications to the existing Whitewater Valley facility in which there are space and operational limitations. A constructibility review will be conducted to address these issues and produce a design that accommodates the planned construction sequence and methods with little disruption to the operation of the facility.

Several design areas will involve significant overlap between the preliminary and detailed design phases including:

- <u>Process Design</u> including heat and mass balances, flowsheets, P&I diagrams, and operating instructions.

- <u>Component Design</u> including mechanical design, equipment specifications, site work, concrete, metal work, and architecture for these components:

  - Injection system including larger limestone silo.

  - Activation chamber including humidification section, inlet/outlet ducts, ash handling, reheat, and recirculation system.

  - Electrical.

- <u>Auxiliary System and Waste Handling and Disposal</u>

  - ID fan upgrading.

  - ESP ash handling including converting to dry system.

  - ESP performance analysis and potential upgrading.

- <u>Cost Estimate, Scheduling, and Layout</u> preparation of the bid packages during the detailed design phase including the purchase orders and subcontracts.

As the engineering and design progresses, the design team will prepare detailed specifications for equipment, materials and supplies, fabrication, and installation. Procurement personnel will use these specifications in Phase IIA and IIB to obtain competitive bids whenever possible. After a thorough review of the quotations by the engineering and management team, ICF Kaiser Engineers will place all the required purchase orders and subcontracts.

In conjunction with the engineering and design effort, ICF Kaiser Engineers and Tampella will prepare a Preliminary Test Plan identifying all the necessary instrumentation and control equipment, sampling ports and locations, process variables, and operating ranges. The design team will incorporate the requirements of the Test Plan into the detailed design, so that field modifications needed for testing purposes are minimized.

Before the detailed design is completed, a constructibility review will be conducted at RP&L to insure that no major problems will be encountered while installing LIFAC during the construction phase.

Task 3 - Environmental Monitoring (WBS 1.1.3)

ICF Kaiser Engineers will manage the environmental task in close coordination with Richmond Power and Light. Three (3) subtasks will be conducted.

Subtask 3.1 - Develop Environmental Monitoring Plan (WBS 1.1.3.1). ICF Kaiser Engineers will complete the Environmental Monitoring Plan (EMP) that was drafted during the negotiation phase. The final EMP will be submitted to DOE for review and approval early in the design phase. The plan will address compliance monitoring and supplemental monitoring required during pre-construction (Design Phase) activities, construction, operations, and post operations of the LIFAC project. The plan will be developed following the outline recommended by DOE in the PON.

Subtask 3.2 - Collection of Baseline Data (WBS 1.1.3.2). During the Design Phase and after receiving DOE approval of the EMP, baseline environmental data will be collected at and around RP&L's Whitewater Valley power plant. Specific baseline data will include:

- Ambient air quality
- Surface water quality
- Groundwater quality
- Terrestrial ecology
- Aquatic ecology
- Noise levels

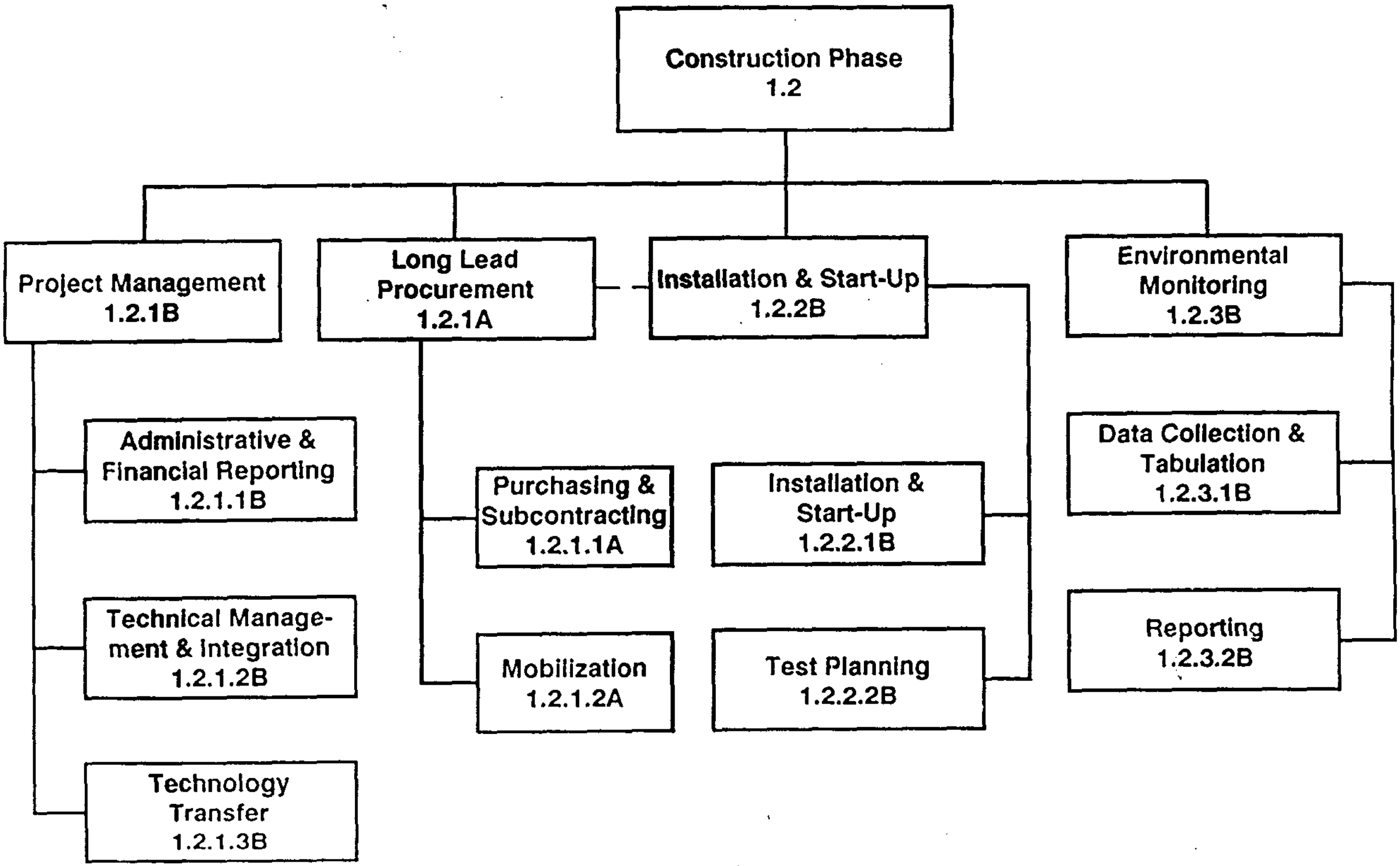
This data will serve as the basis for assessing the environmental and health impacts/benefits of the LIFAC technology. The data collected will be tabulated and reported to DOE for future comparison.

Subtask 3.3 - Permitting and Approvals (WBS 1.1.3.3). ICF Kaiser Engineers will work with Richmond Power and Light to identify and obtain all the necessary federal, state and local permits and approvals required to install and test LIFAC at the Whitewater Valley plant.

PHASE II - CONSTRUCTION (WBS 1.2)

ICF Kaiser Engineers will have primary responsibility for the Construction Phase. However, most of the project activity will be shifted to the host site of RP&L. Work under Phase II is broken down into two parts: Phase IIA is for Long Lead Procurement which will be conducted in conjunction with the Design Phase and Phase IIB which covers actual construction of the LIFAC system. The work breakdown structure for the Construction Phase is presented in Figure 6.

Figure 6 - LIFAC Demonstration Construction Phase Structure



Task 1A - Long Lead Procurement (WBS 1.2.1A)

ICF Kaiser Engineers will be responsible for identifying and procuring all long lead items including purchase orders and subcontracts. This task will occur during the Design Phase so that vendor certified prints can be obtained to finish the detailed final design. Also, special fabricated components will be ordered so that they can be completed and delivered to Whitewater Valley in time for construction. This task will require about four (4) months time and is broken down into two subtasks.

Subtask 1.1 - Purchasing and Subcontracting (WBS 1.2.1.1A). During the preliminary design, engineers and procurement specialists from ICF Kaiser Engineers and Tampella will develop a compete list of equipment, materials and supplies, and subcontracts needed to construct the LIFAC system. Manufacturers suppliers, and contractors will be contacted to assess their qualifications to participate on the project and to determine the lead time required for each item on the construction list. As soon as sufficient details are available, ICF Kaiser Engineers will issue purchase orders and subcontracts for the long lead items and for materials or equipment in which certified prints are required to complete the final design.

Subtask 1.2 - Mobilization (WBS 1.2.1.2A). ICF Kaiser Engineers and RP&L will prepare the host site for receipt of construction materials and supplies. A site plan will be developed to identify the laydown areas for specific equipment and components as they arrive on site. All receipts will be inspected for defects or damage before being accepted. The receipts will also be compared to the actual purchase orders to make sure they are complete or to identify back ordered items.

Once the majority of the materials have arrived on site, the remainder of the construction team, headed up by ICF Kaiser Engineers, will relocate to the Whitewater Valley site. Both ICF Kaiser Engineers and Tampella will have construction managers on site. They will work closely with RP&L's project manager to ensure mobilization and construction activities do not disrupt plant operations.

In conjunction with development of the site plan, a survey will be conducted to set bench marks and develop the layout for the LIFAC installation. Interior modifications, structural and mechanical, will be laid out and reviewed with RP&L personnel before actual construction begins.

The construction management team will provide safety training and site orientation to all field staff and subcontractors prior to any construction activities. Also, the critical path will be reviewed with all field personnel to ensure no slippage occurs on critical path activities.

Task 1B - Project Management (WBS 1.2.1B)

ICF Kaiser Engineers will continue to take the lead in overall project management including coordination between the project team and the DOE.

Subtask 1.1 - Administrative and Financial Reporting (WBS 1.2.1.1B). ICF Resources, on behalf of LIFAC N.A., will continue the administrative and financial reporting efforts initiated during the Design Phase.

Subtask 1.2 - Technical Management and Integration (WBS 1.2.1.2B). ICF Kaiser Engineers's Project Manager will continue day-to-day technical management of the project responsible for coordination among all the project participants and DOE. During the Construction Phase, specific activities that will be completed under this subtask include:

- Updating the Project Management Plan based on results of the Design Phase.

- Development of a <u>Start-up Plan</u> to be submitted to DOE 60 days prior to start-up. The plan, defined by system description, will be followed in commissioning each of the specific systems.

- Preparation of a <u>Start-up and Modification Report</u> to describe results of the start-up effort. The report, submitted within 60 days after start-up is complete, will document any modifications to the design or equipment that were required during start-up. If any performance tests are conducted during start-up, the results will be recorded in the report.

- A <u>Technical Progress/Review Meeting</u> to be held at the end of the Construction Phase to discuss construction and commissioning achievements and lay groundwork for the Operations Phase. The Project Evaluation Report for Budget Period I will also be reviewed.

- A <u>Technical Progress Report</u> that will be prepared after initial construction start-up and subcontractor awards are made.

- Preparation of the <u>Project Evaluation Report</u> for Budget Period I and preparation of <u>Continuation Application</u>. The evaluation report will describe the accomplishments achieved in the Design and Construction Phases and compare the actual results to the target goals set in the evaluation plan. The report will contain updated management plans, costs and schedules. The evaluation report will be the basis for DOE's decision to execute the Continuation Application allowing the team to begin the Operations Phase.

<u>Subtask 1.3 - Technology Transfer (WBS 1.2.1.3B)</u>. The project team will continue its technology transfer efforts to keep the project sponsors, participants and industry informed of the LIFAC demonstration project. At least one technical paper and one exhibit will be planned for during the Construction Phase.

<u>Task 2B - Installation and Start-up (WBS 1.2.2B)</u>

This is the largest task in the Construction Phase of the project in terms of total expenditures. Two subtasks have been identified.

<u>Subtask 2.1 - Installation and Start-up (WBS 1.2.2.1B)</u>. Once the Construction Phase begins, materials or supplies not procured in Phase IIA will be ordered. This includes standard off-the-shelf items such as pipe, valves, fittings, wire, conduit, safety supplies, concrete, rebar, fabricated steel, etc. Once all materials have been received, the construction team will oversee all structural, mechanical, and electrical installation. They will be responsible to keep the installation contractor(s) on schedule and within budget. Construction activities will be centered around four (4) specific areas:

- Modification and enhancement to the existing sorbent injection system. This will include the addition of a new limestone storage bin; winterization of the limestone feed system; repairs and upgrades to existing blowers, feeders, and compressors; installation of injection ports and nozzles; and revamping of injection piping.

- Installation of the activation chamber and slag bin including tying into the existing ductwork between the air preheater and the ESP. A humidification section will be installed along with a reheating section after the activation chamber. A conveyor system and slag bin will also be installed to dispose of slag dropping out of the hoppers in the activation chamber.

- Modification of the fly ash handling system. RP&L will convert the existing wet conveyance system to a dry system. The ID fan will be upgraded to handle the additional load caused by the LIFAC system, and a recirculation system will be installed between the ESP hoppers and the activation champer.

- Installation of all electrical, instrumentation, and control equipment required to operate LIFAC and interact with boiler operations.

All critical tie-ins into the existing boiler and auxiliary systems will occur during RP&L's spring outage (March, 1991).

Once construction activities are completed, each individual component/system will be checked out and tested according to the Start-up Plan. All start-up changes and modifications will be documented so that they can be included in the Start-up and Modification Report. After each specific component/system is made fully functional, the total system (boiler and LIFAC) will be tested to make sure there are no problems with interaction between the different systems. Any deficiencies will be corrected and documented before moving on to the Operations Phase.

<u>Subtask 2.2 - Test Planning (WBS 1.2.2.2B)</u>. ICF Kaiser Engineers, with input from the other project participants, will develop a detailed Test Plan. The Test Plan will include experimental design, equipment specifications, analytical procedures, manpower requirements, evaluation criteria, description of process variables and their operating ranges. The Test Plan will identify the goals and objectives of the LIFAC demonstration.

The process variables that will be evaluated include:

- Coal quality level (sulfur content)
- Limestone quality
- Ca/S molar ratio
- Boiler load/operating temperatures
- Sorbent injection location/secondary air
- Humidification
- Recirculation of sorbent material

Throughout the test program, the Test Plan will be designed to assess the impact the LIFAC process has on boiler operation and performance, particularly:

- Reductions of SO_2 and NO_x emissions
- Boiler efficiency and availability
- Particulate emissions
- ESP performance
- Solid waste disposal

The Test Plan will be refined as test work is conducted and preliminary results are obtained.

<u>**Task 3B - Environmental Monitoring (WBS 1.2.3B)**</u>

ICF Kaiser Engineers will continue to manage the environmental effort during the Construction Phase. Two (2) subtasks are required.

<u>**Subtask 3.1 - Data Collection and Tabulation (WBS 1.2.3.1B)**</u>. To assess any potential environmental or health impacts during installation of the LIFAC process, ICF Kaiser Engineers will continue to collect the same baseline data as that collected in the Design Phase. Additionally, the environmental monitoring team will assess worker health and exposure and ambient impacts due to noise or fugitive dust caused by the construction activity. Construction waste materials will be monitored to ensure no hazardous materials are being disposed of improperly.

Subtask 3.2 - Reporting (WBS 1.2.3.2B). The ICF Kaiser Engineers' monitoring team will tabulate all the environmental data collected during the six-month Construction Phase and compare it to the baseline data collected during the Design Phase. The data and the results of the comparison will be presented in an Environmental Monitoring Report and submitted to DOE within sixty (60) days of completing the Construction Phase.

PHASE III - OPERATIONS (WBS 1.3)

The 26-month Operations Phase of the LIFAC demonstration will be directed by ICF Kaiser Engineers and conducted by a team including staff from ICF Kaiser Engineers, Tampella, and RP&L. As in the previous two phases, the work in this phase is broken down into three tasks (see Figure 7).

Task 1 - Project Management (WBS 1.3.1)

ICF Kaiser Engineers will continue overall management of the project. The same three subtasks will be used as in the previous two phases.

Subtask 1.1 - Administrative and Financial Reporting (WBS 1.3.1.1). ICF Resources will continue to collect the cost information from the project participants and will provide the appropriate forms and reports to DOE as required.

Subtask 1.2 - Technical Management and Integration (WBS 1.3.1.2). Throughout the Operations Phase, ICF Kaiser Engineers will be responsible for project management and coordinating among the project participants and the DOE. Specifically, ICF Kaiser Engineers will:

- Update the Project Management Plan to reflect the findings/changes identified in the Project Evaluation Report for Budget Period I.
- Prepare Technical Progress Reports on a quarterly basis to keep the project participants and DOE informed of the test results as they become available.
- Hold Project Review Meetings at DOE-PETC and at the RP&L site to review test results, discuss problems and solutions, and present possible changes to the Test Plan to DOE for review and approval.
- Prepare a Technology Performance and Economic Evaluation Report which will present LIFAC N.A.'s economic evaluation of the LIFAC demonstration project and how the results may impact commercialization of the technology. This report will be submitted to DOE in draft form 60 days before the project is completed.

Subtask 1.3 - Technology Transfer (WBS 1.3.1.3). Throughout the Operations Phase, the project team will prepare technical papers and presentations to be given at domestic and international conferences or workshops to keep the utility industry informed of LIFAC demonstration results. The team may also prepare a video describing the operation/benefits of the LIFAC technology. Also, during the Operation Phase, the project team will continue exhibiting at the major utility conferences.

APPENDIX E

LIFAC WASTE COLUMN AND AGITATION TESTS

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LIFAC WASTE COLUMN AND AGITATION TESTS

The wastes tested came from the Inkoo powerplant on the southern coast of Finland west of Helsinki. This 1000 MW powerplant has four 250 MW pulverized coal-fired boilers (wall-fired). At each unit, the flue gas stream splits into two equal, parallel flow paths after the air preheater with each flue gas stream having its own ESP. In February 1986, Tampella installed a full capacity injection system and an activation chamber for about one-half of one of the two flue gas streams at Unit 4, representing 70 MW of the plant capacity of 250 MW. Column and agitation tests were preformed on waste collected from the ESP. The aim of these dissolution tests was to find out how much different trace elements dissolve in the solvent liquid.

After collection the waste was stabilized during one month period by adding some water into the waste. The aim of the stabilization was to get the active calcium compounds to convert to the inert ones. The samples of the waste for the dissolution tests were taken under variable boiler load and sulphur removal conditions. The analysis of the test coal is shown in Table 1. The analysis of the test limestone is shown in Table 2. The analysis of the waste used in the tests is shown in Table 3.

Agitation Tests

The agitation test method used was the Swedish ENA-Test which has been developed from the EPA agitation test. ENA-TEST is a two phase test. In the first phase the sulphur removal waste is added into certain water amounts in four equal batches. Each mixture is agitated 24 hours. In the second phase of the test water is added into certain waste amounts in four equal batches. Each mixture is again agitated 24 hours. By analyzing each filtrate or collecting filtrate the trace elements dissolved with each solid/liquid ratios may be determined. The principle of the ENA-Test is shown in Figure 1.

TABLE 1

ANALYSIS OF THE AMERICAN TEST COAL

Coal	74.6%
Hydrogen	4.6%
Oxygen	5.3%
Nitrogen	1.4%
Sulphur	1.5%
Ash	12.6%

ANALYSIS OF THE AMERICAN COAL ASH

pH	10.6%
Water	0.03%
Organic matter	2.3%
$CaCl_2$	0.02%
$CaC0_3$	0.25%
$Ca(OH)_2$	3.7%
CaO (free)	0.4%
$CaSO_3$	0.08%
$CaSO_4$	0.55%
S (tot.)	0.15%
SiO_2	50.4%
Al_2O_3	23.0%
Fe_20_3	11.6%
$Ti0_2$	1.1%
CaO	3.3%
MgO	1.4%
Na_2O	0.6%
K_2O	2.7%

TABLE 2

ANALYSIS OF THE OOTHLAND TEST LIMESTONE

SiO_2	0.13%
Al_2O_3	0.51%
Fe_2O_3	0.23%
MgO	0.85%
Na_2O	0.03%
K_2O	0.13%
$CaCO_3$	97.00%

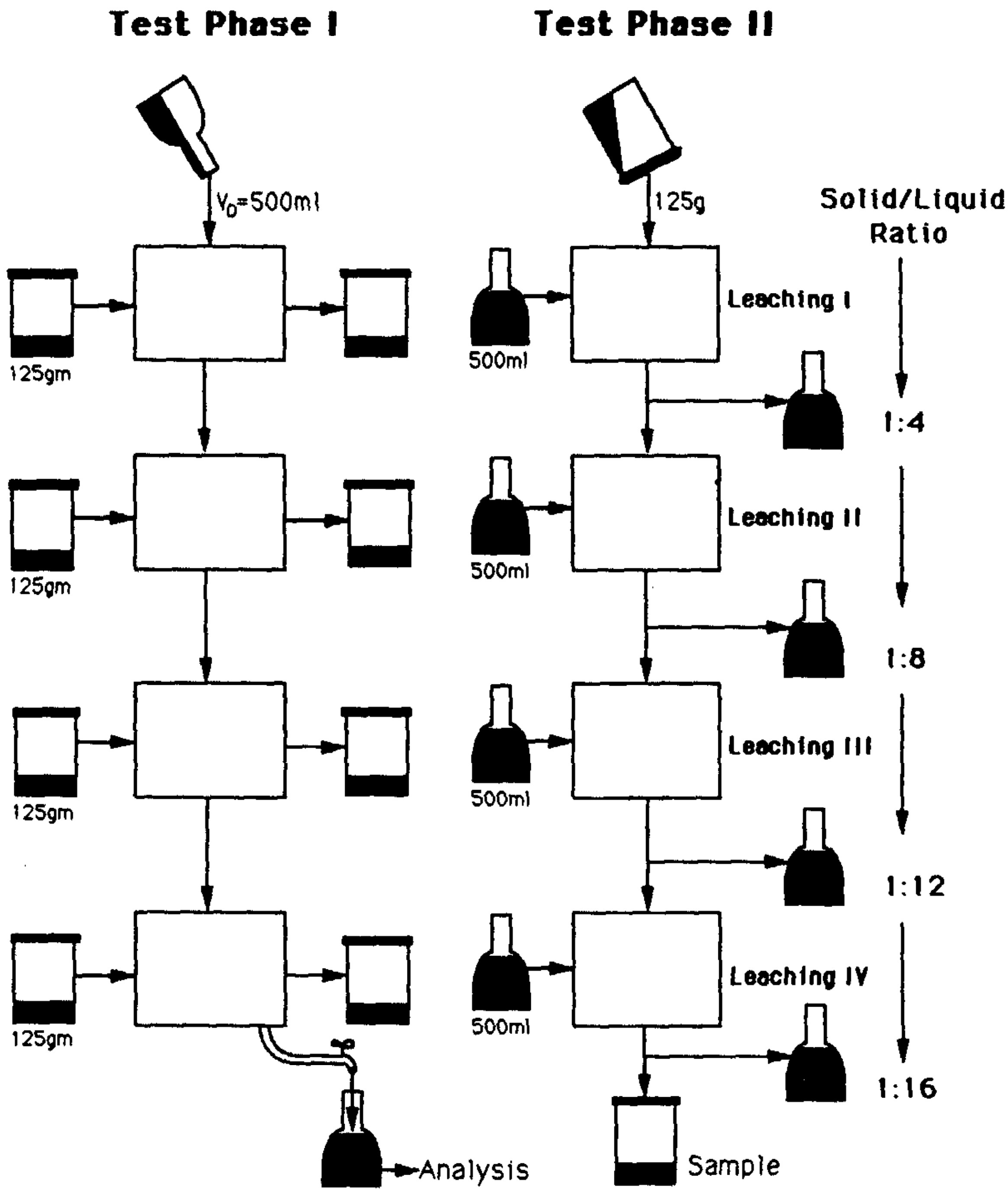
TABLE 3

ANALYSIS OF THE LIFAC WASTE

pH	11.5%
$Ca(OH)_2$	2.1%
CaO	2.8%
Cl	0.34%
S (tot.)	1.69%
SO_4	11.9%
SO_3	0.56%
CO_3	2.99%
P (tot.)	0.1%
SiO_2	24.4%
Al_2O_3	11.7%
TiO_2	0.7%
Fe_2O_3	6.0%
CaO (tot.)	15.2%
MgO	0.9%
Na_2O	0.4%
K_2O	1.6%

FIGURE E-1

PRINCIPLE OF THE AGITATION TEST



Column Tests

The principle of the column test is shown in Figure 2. The column contains 14 kg of dry LIFAC waste compacted by the a vibrator. The water pumping was started in September 18, 1987. The water flow through the column since then has been 850 ml per week.

Results of the agitation and column tests are shown in Tables 4 and 5.

FIGURE E-2

PRINCIPLE OF THE COLUMN TEST

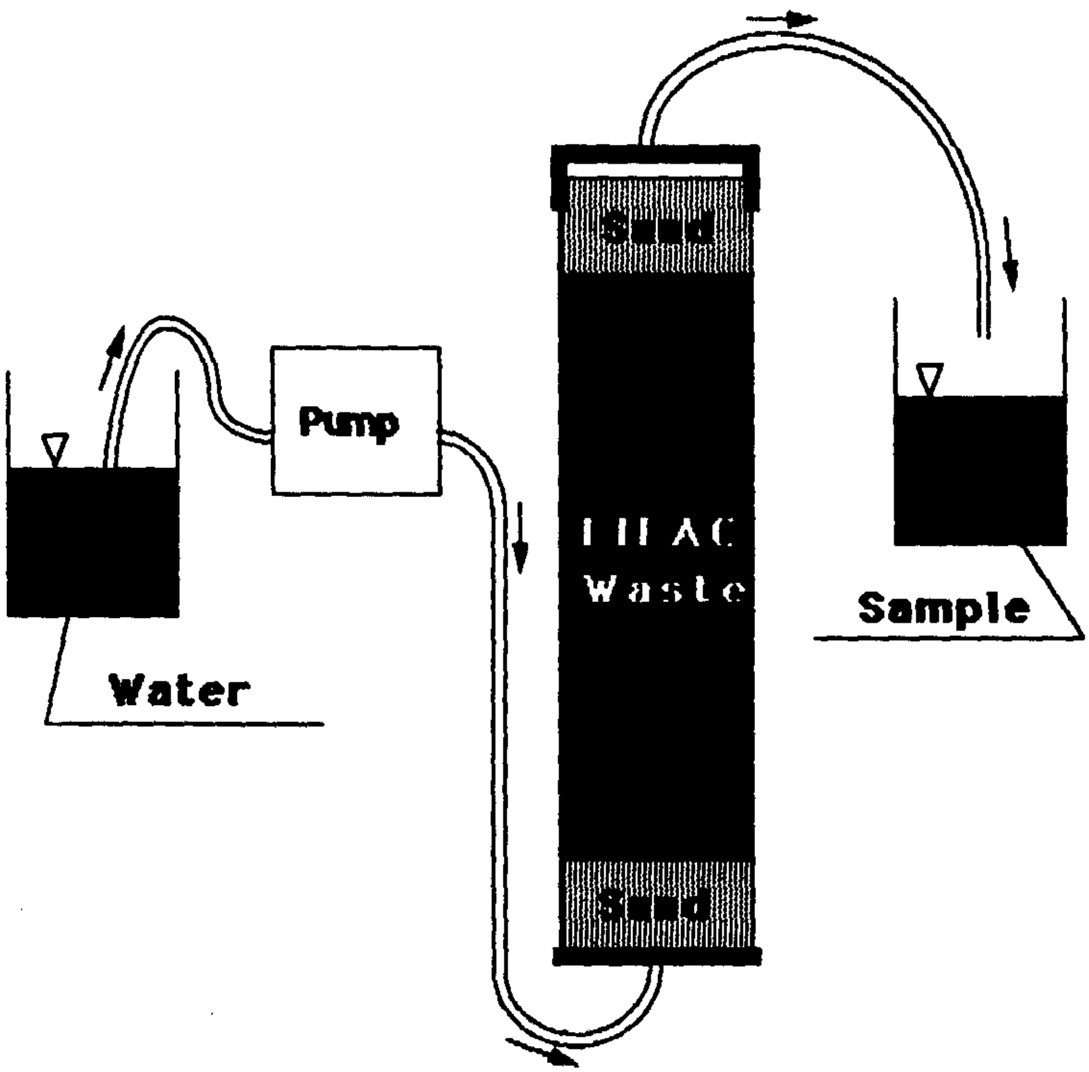


TABLE 4

ANALYSIS OF THE AGITATION TEST SAMPLES

Liquid/Solid Ratio	1:1	4:1	8:1	12:1	16:1
pH	12.0	11.7	11.3	11.0	11.2
Spec. Conductivity ms/m	1,275	537	252	184	157
Solid Matter mg/l	24	37	22	19	12
Evaporation Residue g/l	5.82	3.14	0.80	0.58	0.50
Ignition Residue g/l	5.68	2.02	0.80	0.50	0.42
Total Hardness mmol/l	0.79	1.33	2.56	3.09	3.80
Cl (mg/l)	1,200	485	130	67	42
Br (mg/l)	11	33	1.5	0.8	0.5
NO_2 (mg/l)	<0.1	(0.1	<0.1	<0.1	<0.1
NO_3 (mg/l)	0.8	0.5	0.2	0.2	0.2
SO_4 (mg/l)	200	60	22	22	25
PO_4 (mg/l)	<0.1	<0.1	<0.1	<0.1	0.1
kok. P (mg/l)	0.064	0.136	0.065	0.075	0.01
NH_3 (mg/l)	0.40	0.67	0.36	0.38	0.39
Mg (mg/l)	0.08	0.17	0.12	0.09	0.05
Ca (mg/l)	37.3	65.2	127	165	164
Na (mg/l)	511	111	40	10.7	3.5
K (mg/l)	2,115	694	216	73	27
Fe (mg/l)	0.24	0.62	0.30	0.28	0.16
Mn (mg/l)	<0.04	<0.04	<0.04	<0.04	<0.04
Ba (mg/l)	0.5	0.7	0.7	0.7	0.6
Mo (mg/l)	3.2	0.9	0.3	0.2	<0.1
Al (mg/l)	14.8	10.4	8.1	7.4	7.5
V (mg/l)	0.5	<0.5	<0.5	<0.5	<0.5
Cu (mg/l)	0.01	0.02	0.01	0.01	<0.01
Pb (mg/l)	<0.05	<0.05	<0.05	<0.05	<0.05
Cd (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01
Zn (mg/l)	0.01	0.01	0.01	0.01	<0.01
Cr (mg/l)	0.61	0.14	0.04	<0.04	<0.04
Ni (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1

TABLE 5

THE ANALYSIS OF THE COLUMN TEST SAMPLES

Liquid/Solid	0.1	0.22	0.32	0.42	0.52	0.63	0,75
pH	12.0	12.2	12.3	12.2	12.1	12.1	12.0
Spec. Conductivity ms/m	3470		1700		1020	1003	916
Solid Matter mg/l	49	14	<0.2		2.0		
Evaporation Residue g/l	29.03	20.30	10.97		5.84		
Ignition Residue g/l	21.44	15.49	10.75		5.79		
Total Hardness mmol/l	0.51	0.66			0.23		
Cl (mg/l)	7010	6750	4162		1500		
Br (mg/l)	110	90	46		17.2		
NO_2 (mg/l)	<0.1	<0.1	<0.1		<0.1		
NO_3 (mg/l)	5	2.5	1.9		1.5		
SO_4 (mg/l)	350	480	604		560		
PO_4 (mg/l)	<0.1	<0.1	<0.1		<0.1		
kok. P (mg/l)	0.161	0.128	0.127		0.122		
NH_3 (mg/l)	0.40	0.40	0.42		0.36		
Mg (mg/l)	0.16	0.06	0.004				
Ca (mg/l)	23.2	37.6	9.5				
Na (mg/l)	1920	1440	920				
K (mg/l)	7780	6040	3640				
Fe (mg/l)	0.86	0.27	0.60				
Mn (mg/l)	0.04	0.04	<0.04				
Ba (mg/l)	<0.5	<0.5	<0.5				
Mo (mg/l)	16.2	16.8	10.3				
Al (mg/l)	19.1	17.3	18.6				
V (mg/l)	0.6	1.0	1.7				
Cu (mg/l)	0.06	0.04	0.03				
Pb (mg/l)	<0.05	0.05	<0.05				
Cd (mg/l)	<0.01	<0.01	<0.01				
Zn (mg/l)	0.12	0.02	0.12				
Cr (mg/l)	0.88	0.05	<0.04				
Ni (mg/)l	<0.1	<0.01	<0.01				
S (mg/l			198.6		209.2		